SNOWFALL IN ILLINOIS

BY

LEON THOMAS STEWART

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THESIS

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I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY SUPERVISION BY Leon Thomas Stewart

ENTITLED SNOWFALL IN ILLINOIS

BE ACCEPTED* AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE DEGREE OF Master of Arts

John L. Page

In Charge of Thesis

Head of Department

Recommendation concurred in†

Committee on Final Examination†

* Subject to successful final examination in the case of the doctorate.
† Required for doctor's degree but not for master's.

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PREFACE

This thesis has been written under the supervision and encouragement of Dr. John L. Page, Associate Professor of Geography, University of Illinois, without whose constructive criticism and sympathetic understanding this thesis would never have been accomplished. Acknowledgment is made of the cooperation and assistance of Mr. E. W. Holcomb, Chief of the Illinois Section of the United States Weather Bureau, members of the Iowa Section, and personnel of the several first order Weather Bureau stations for their promptness in searching for and furnishing climatological data. Appreciation is also expressed to those members of the Highway Department, the Railway Companies, and Weather Bureau Stations who could contribute little but took time to complete the correspondence. Helpful information and suggestions were made by flying personnel of the Department of Weather at Chanute Air Force Base. Data for the synoptic weather maps were also obtained from the Historical Weather Maps and the file of analyzed maps of the Department of Weather.

A rather large number of maps and graphs were used with the belief that a graphical presentation was worth more than long tables or wordy description. Isarithmic lines were drawn as accurately as possible for all stations, unless radical variations due to short records were recognized.

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SNOWFALL IN ILLINOIS

INTRODUCTION

To make a complete study of snowfall for an area the size of Illinois one naturally should have adequate and detailed records containing information as to total snowfall, duration of snow cover, number of days of snowfall, water equivalent, and data for individual storms. Only a few first order Weather Bureau stations keep all such records while much of the data available is limited to the total number of inches of snow per month, measured once a day or at the end of each storm, by the many Cooperative Observers over the state. Nevertheless, a rather complete picture can be made of the total snowfall in Illinois, its variability, the geographical and seasonal distribution, the causes and controls, and some of the relations and consequences that result.

Snow is defined as precipitation in a solid state mainly in the form of branched hexagonal crystals, often mixed with single ice crystals. To form snow, water vapor condenses or sublimates directly into ice crystals. At temperatures above -10° C. they generally link together to form snowflakes. Once the ice crystal forms, the vapor pressure over the ice crystal is decreased and a gradient is directed toward the crystal causing it to continue its growth.

Snowfall is a small but important part of the total precipitation for the state and is confined, for the most part, to the months November through March. However, snowfall has been recorded in Illinois at least once in every month of the year. Late snows in April and May tend to occur more frequently than early snows of September and October. Since so little data exist on individual storms concerning water equivalent of the snowfall, one can only approximate the per cent of total precipitation that falls as snow. For most snow it requires 5 to

15 inches to equal one inch of rainfall. Trewartha[1] says the ratio may vary from 5 to 50 inches of snow to an inch of water. A generally used average is 10 inches of snowfall as the equivalent or one inch of rainfall. Using this figure and statewide averages for the period 1890 through 1947, it is learned that only 5.9 per cent of the total precipitation is snow. The year 1912 had the largest snowfall average for the state during the above mentioned period of record and even then only 10.4 per cent of the total precipitation was snowfall. During 1927, a year of maximum precipitation, snowfall accounted for only 3.5 per cent of the total. The year of 1947 was approximately a normal year with snowfall accounting for the 5.9 per cent of the total precipitation. Considering the individual Climatic Sections as delimited by the Weather Bureau for the state and shown as Fig. 1, the percentages of total precipitation supplied by snowfall are 7.8 per cent for the northern, 5.2 per cent for the central, and 4.1 per cent for the southern section. It seems that in a humid state such as Illinois, snowfall is of importance not so much for the amount of precipitation or water it gives but rather on the conditions resulting from its physical characteristics and properties.

CAUSES AND CONTROLS

Most clouds and precipitation are the result of dynamic cooling caused by vertical motion of the air. The only processes that can cause such marked vertical motion and cooling in the atmosphere are convection, orographic lifting, frontal lifting, and convergence in a cyclonic area. The major controls and factors involved in the production of snow for Illinois are the migrating cyclones and their accompanying frontal systems, associated air masses, and wind patterns.

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1. Trewartha, G. T.: An Introduction to Weather and Climate, 1944, p. 178.

Figure 1. Names and locations of stations from which data were used in this study.

Convection is at a minimum in winter and the terrain of Illinois is such that orographic effects are of little significance.

The most frequent snowfalls accompany the Alberta and Colorado Lows and their associated cold fronts. These systems usually move in from a general westerly direction with well defined cold fronts causing wind shifts from southerly to westerly or northwesterly, a sharp drop in temperature, and light to moderate precipitation. Snow often continues or even develops after the frontal passage and falls from the stratocumulus clouds that develop in the cold continental polar air masses behind the front. These cyclonic storms seldom move far enough south to have associated with them real maritime tropical air as the overrunning air mass, with the result that neither the air mass ahead and overrunning the cold frontal surface nor the continental polar air behind the front have enough moisture to make excessive precipitation possible. Nevertheless, strong gusty winds often accompany these storms and the light, dry, fluffy snow is subject to much blowing and drifting but seldom has enough volume to become a serious hazard for any length of time. In Illinois, as in most of northcentral and eastern United States, snowfall occurs more frequently with north to west winds, but the heaviest snowfalls come with east to northeast surface winds.

The typical synoptic weather map with which the heavy snowfalls of Illinois are associated features a Texas wave cyclone with a definite warm front extending eastward from its center. The low pressure area develops in the Texas-Louisiana region and travels northeastward with the low center moving across or just south of Illinois. The warm front separates the colder continental air to the north from the maritime tropical Gulf Air Mass that is in the warm sector to the south and southeast. The maritime air moves northward and up the warm frontal surface over the colder denser air below. The continued flow of maritime air is able to supply abundant moisture to replace that which condenses and is precipitated out.

Surface data in the northeastern portion of the storm will show cyclonically curved isobars and easterly winds blowing toward the low pressure. The snow coming from the maritime air as it rises over the warm frontal surface falls through it into the colder air below where it is caught by the easterly winds and driven along by them, giving the appearance of having actually originated within the easterly winds. Both the air mass aloft and at the surface must have temperatures below freezing for snow to form and continue to exist. If the temperatures near the surface are above freezing, the snow melts and reaches the surface as rain. If the air aloft is above freezing, rain rather than snow will form and the temperatures near the surface will determine whether it falls as rain or sleet. The saying "too cold to snow" has little meaning since the surface temperatures may have little relation to the temperatures of the air mass aloft from which the snow is formed and precipitated. However, it is true that the heaviest snow storms usually occur when the temperatures are just slightly below freezing. An example of the above conditions may be seen in Fig. 2 which shows the rawinsonde report for Joliet on January 17 and 18, 1949. Curve "A" for 9 P.M. on the 17th shows low surface temperatures with warmer air overrunning at a level where pressure is about 850 millibars (approximately 5000 feet). Snow was falling from the stratus clouds at that level into the colder air below. Twelve hours later (Curve B) the temperature in the maritime air aloft had risen to above freezing and rain was falling into the colder air below, becoming freezing rain with ice and glaze covering the surface. When the cold front of the system passes, the winds shift to the west or northwest and often increase in speed. This wind change and the sharp temperature drop that occurs with the strong advection of cold air cause the severe drifting and blowing snow that so often follows the heavy snow storm. These conditions are intensified if the frontal systems form

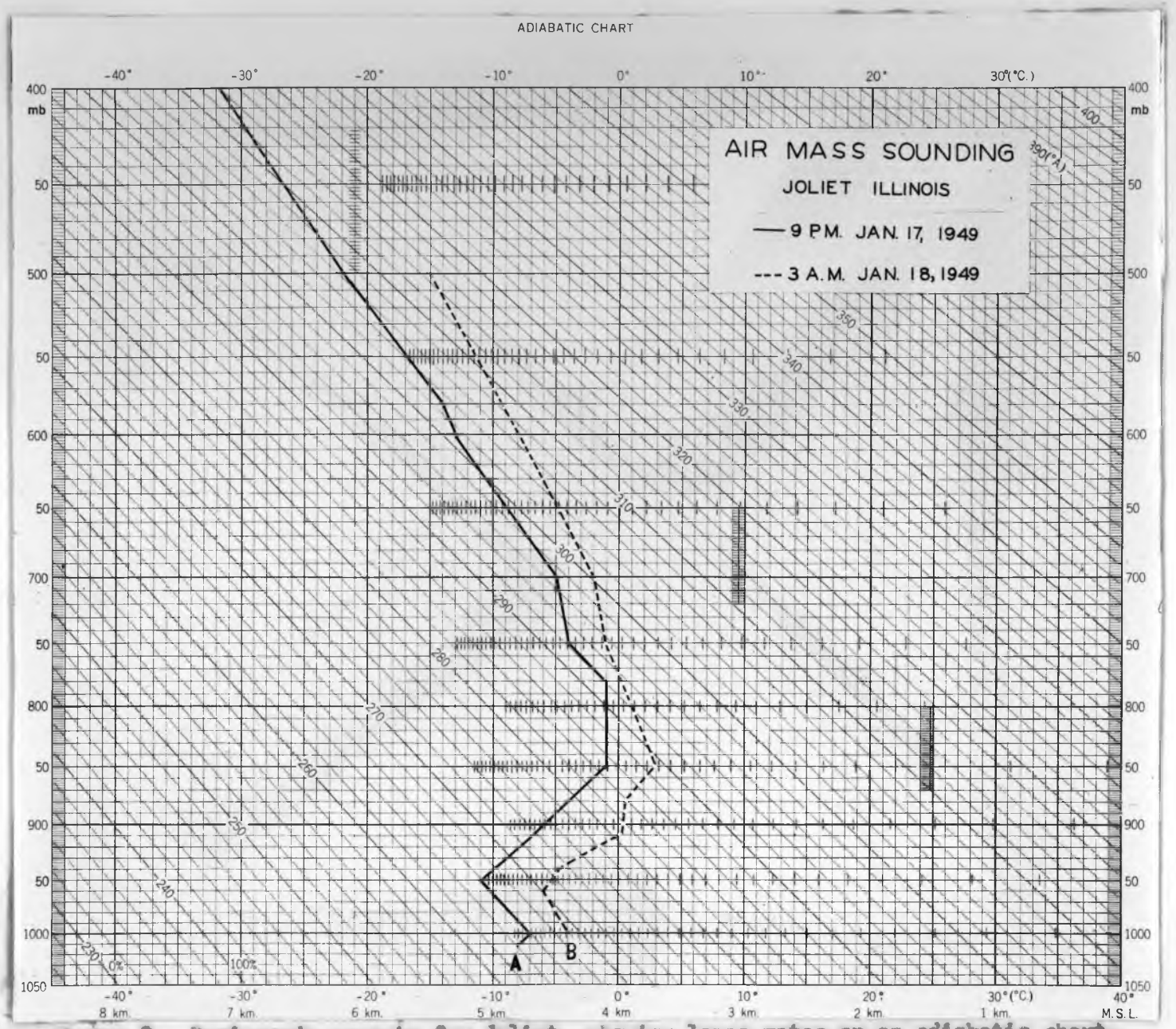

Figure 2. Rawinsonde reports for Joliet, showing lapse rates on an adiabatic chart.

an occlusion by the time they reach Illinois. January of 1918 was the most severe month in the Climatological history of Illinois. That year numerous low pressure areas of the Texas type developed and moved northeastward toward Lake Erie giving Illinois a series of snowstorms followed by cold waves. Large amounts of snow fell and the low temperatures that followed prevented melting or rapid evaporation so that a snow cover persisted for a much longer time than average.

Figures 4, 5, and 6 show actual synoptic weather maps illustrating heavy snowstorms with the typical conditions of the "Texas Low" described above. Fig. 3 portrays the meaning of the symbols used on Figures 4, 5, and 6. Fig. 4 shows the weather map for February 28, 1900 at 6:00 A.M. Central Standard Time.[1] A Texas Low had developed, and moved northeast with an occlusion forming just south of Illinois. The easterly component of the winds in advance of the warm front can be noted. These surface winds are blowing the falling snow from the east although the air aloft from which the snow is actually falling is moving from the south and southwest. This storm gave heavy snowfall over most of the state, with 30 inches being recorded at Astoria. This is a record for that station and "old timers" agree that it was the biggest snow since 1830,[2] for which there was no record. A heavy late snowfall situation is shown by the weather map for March 20, 1924. (Fig. 5) Ten to fifteen inches of snow fell in 24 hours in the region around St. Louis. This also was a Texas cyclone. The center of the low passed south of the state and caused only light to moderate snowfall in the northern part. Temperatures at the surface in the southern part of the state were high enough to cause rain rather than snow. A third map (Fig. 6) illustrates a heavy December 1944 snow. The heavy snow belt of this storm was confined to the north-

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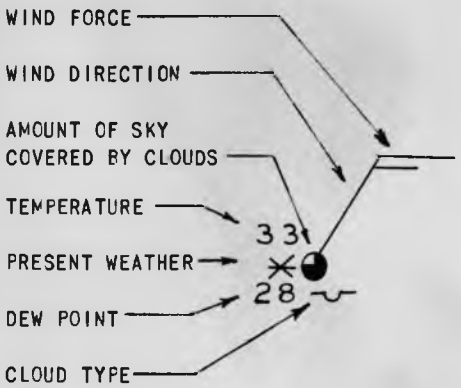
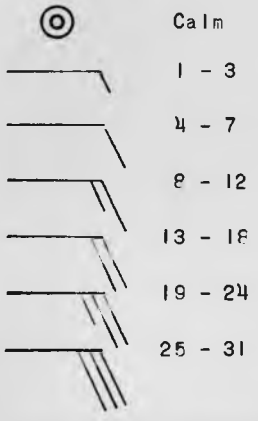
1. This map was taken from the "Historical Series". In 1900 dew points were not indicated, thus their absence on this map.

2. United States Dept. of Agriculture: Climate and Crop Service of the Weather Bureau, Illinois Section, February 1900, p. 3.

STATION MODEL AND EXPLANATION OF WEATHER FIGURES AND SYMBOLS



VALUE IN MILES PER HOUR FOR NUMBERS ON BEAUFORT SCALE



cP - Continental Polar Air Mass
mP - Maritime Polar Air Mass
mT - Maritime Tropical Air Mass
w - Warmer than surface
k - Colder than surface

Warm Front

Cold Front

Occluded Front

Stationary Front

CLOUD TYPES

Cumulus Humulus

Stratocumulus

Fractostratus of bad weather

Thin Altostratus

Thick Altostratus

Cirrus

Cirrostratus

SYMBOLS FOR PRESENT WEATHER

Intermittent light rain

Rain within last hour

Continuous light rain

Continuous heavy rain

Intermittent light snowfall

Snow Showers

Continuous snowfall

Sleet

Fog

Smoke

Areas of precipitation

Figure 3. Station model and key to symbols used on figures 4, 5, and 6.

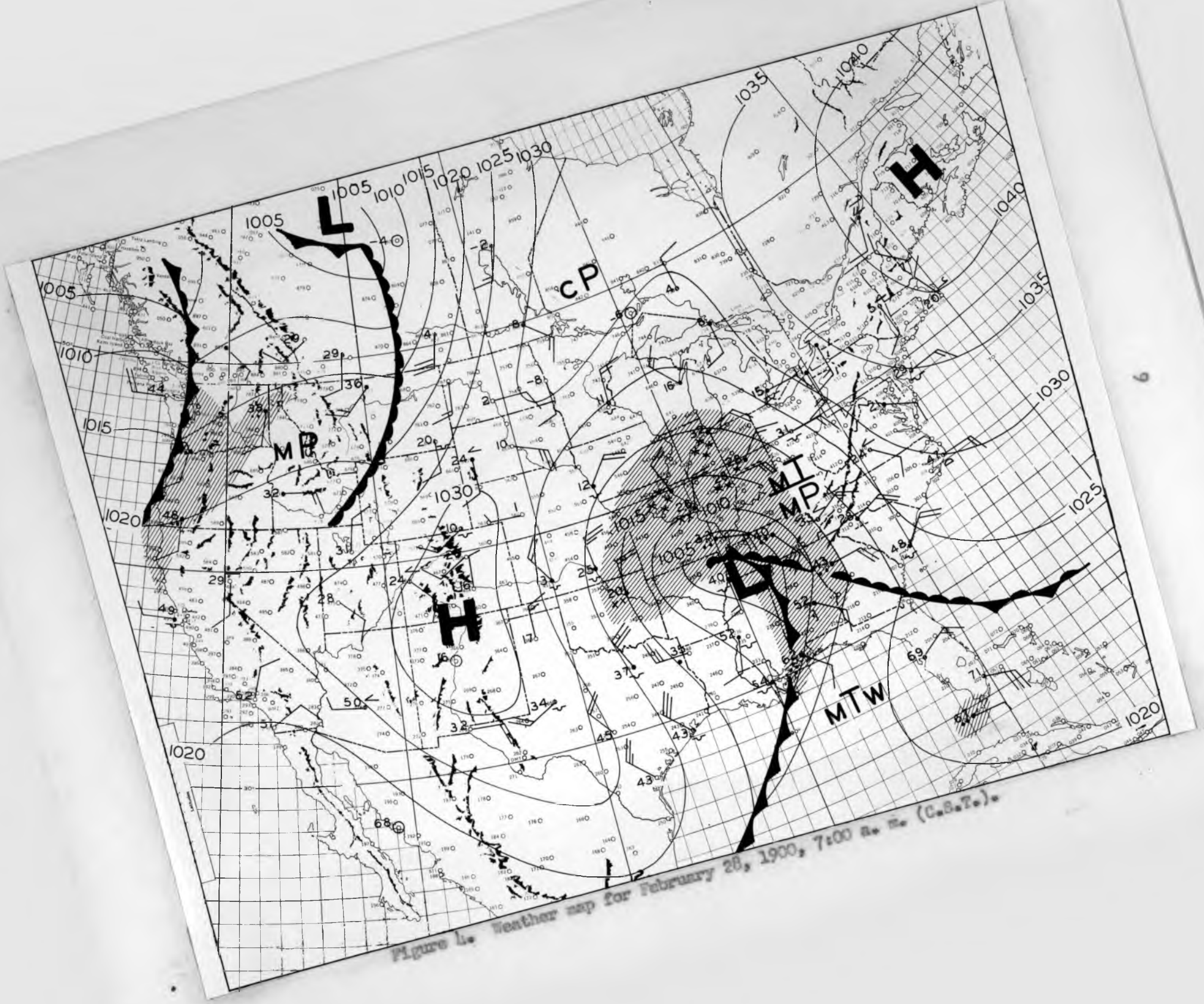


Figure 1. Weather map for February 28, 1900, 7:00 a. m. (C.S.T.).

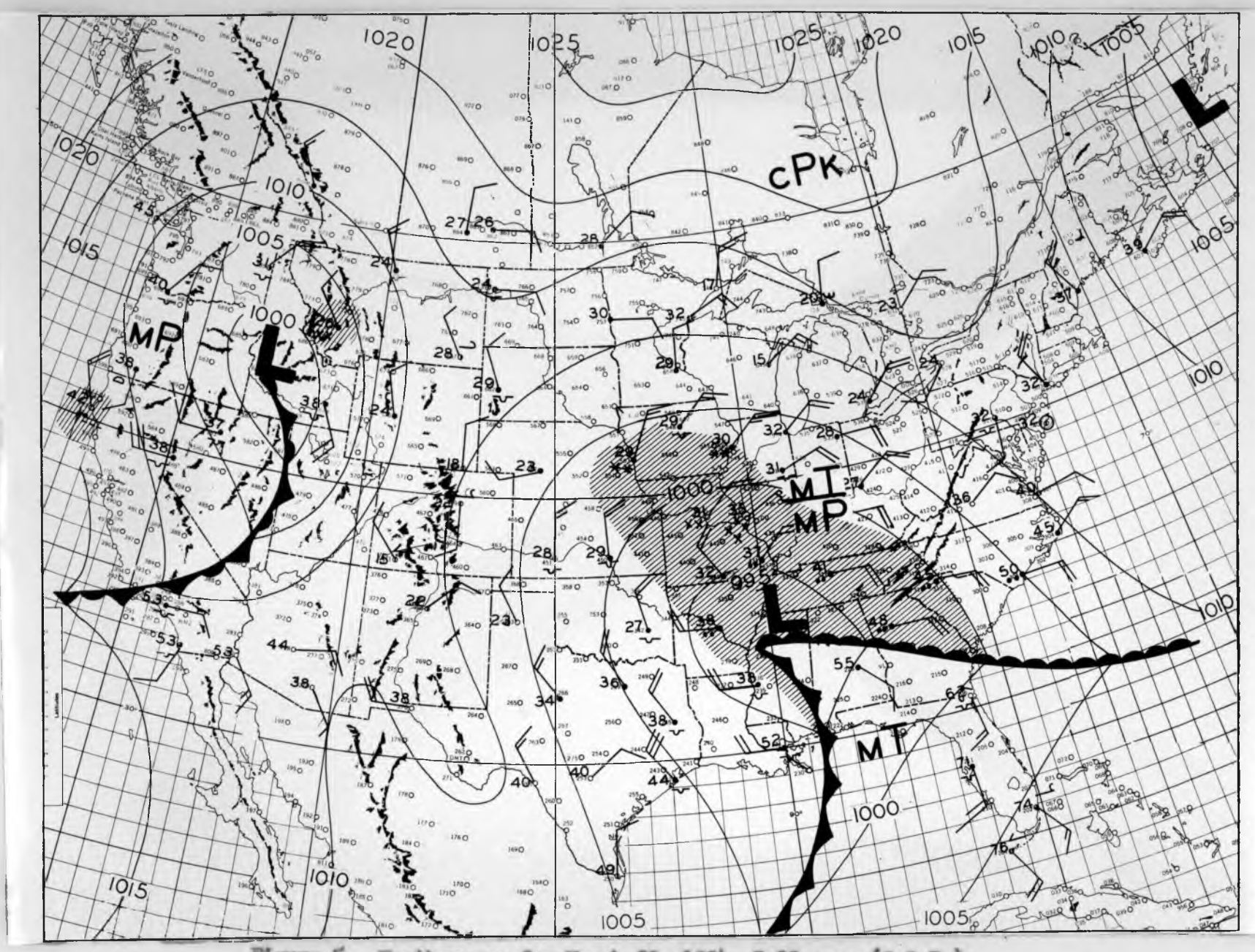


Figure 5. Weather map for March 20, 1924, 7:00 a.m. (C.S.T.).

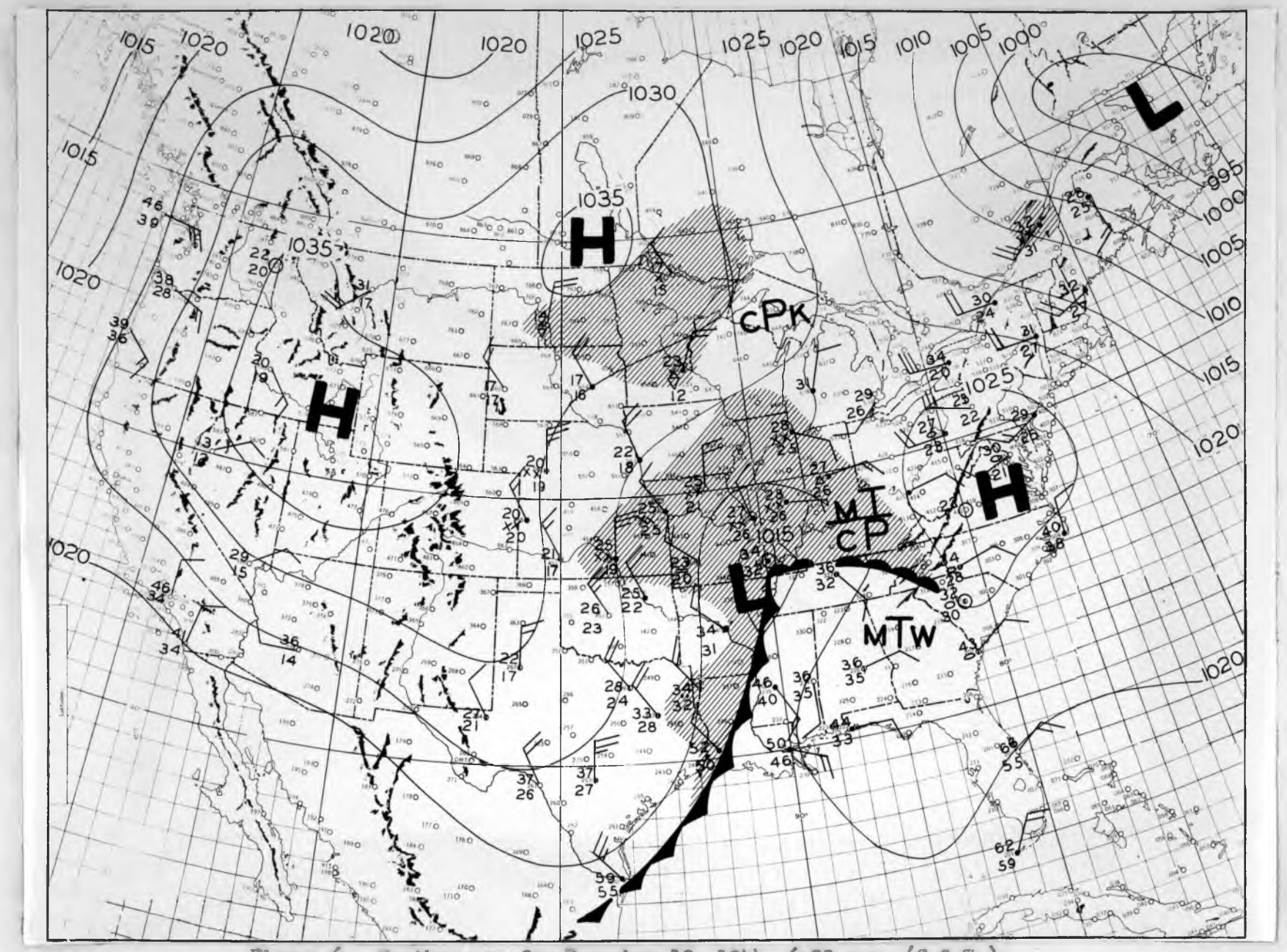


Figure 6. Weather map for December 10, 1944, 6:30 a.m. (C.S.T.).

ern part of the state since the center of the storm moved across the southern part. As in the preceding examples, this storm was a Texas type cyclone. The occlusion began in Illinois and the heavy precipitation occurred just to the northeast of the low center.

GEOGRAPHICAL DISTRIBUTION

The geographical distribution of snowfall over Illinois is shown by Figures 1 through 12. There is a general decrease from the northwest where the average annual is over 34 inches to the south and southeast where it is less than 10 inches. (Fig. 7) This pattern follows, in general, the winter temperature distribution which must be the greatest single factor affecting the pattern. The January temperatures at stations in the extreme southern part of the state do not average below freezing. This would tend to indicate that much of the precipitation there would not fall as snow. Some of the sinuosities of the lines of equal snowfall and patterns on the several maps are, no doubt, due to the localization and variations in the individual storms and to the differences in the length of records for the various stations. An exception to this is the narrow belt of heavy snowfall at Chicago and the southwestern shore of Lake Michigan where winds crossing the Lake have gained enough extra moisture to develop stratocumulus clouds and snow showers. The increase in elevation of the terrain in the northwestern part of the state may be a factor in the increase in snowfall for that area.

Only the months from December through March have enough snowfall to warrant their mapping. The pattern of the December map (Fig. 8) is essentially the same as the annual with a steady decrease of from 7 inches at Dubuque to 2 inches or less in the southeast. An area of less than 6 inches of snowfall can be noted in the extreme nort eastern portion of the state. This appears to be due to the relatively high temperatures acquired in trajectories of the air over Lake

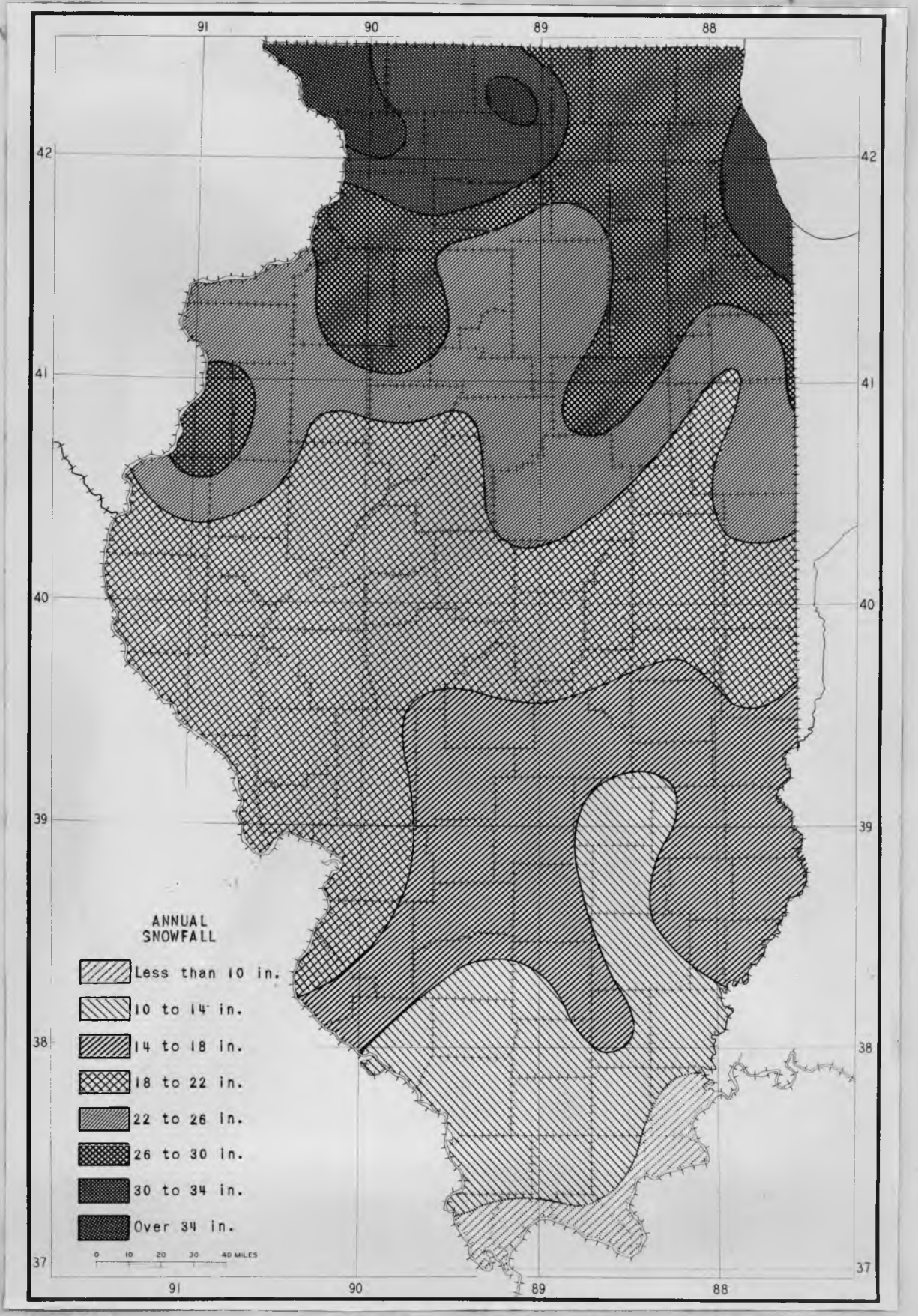


Figure 7. Annual Snowfall.

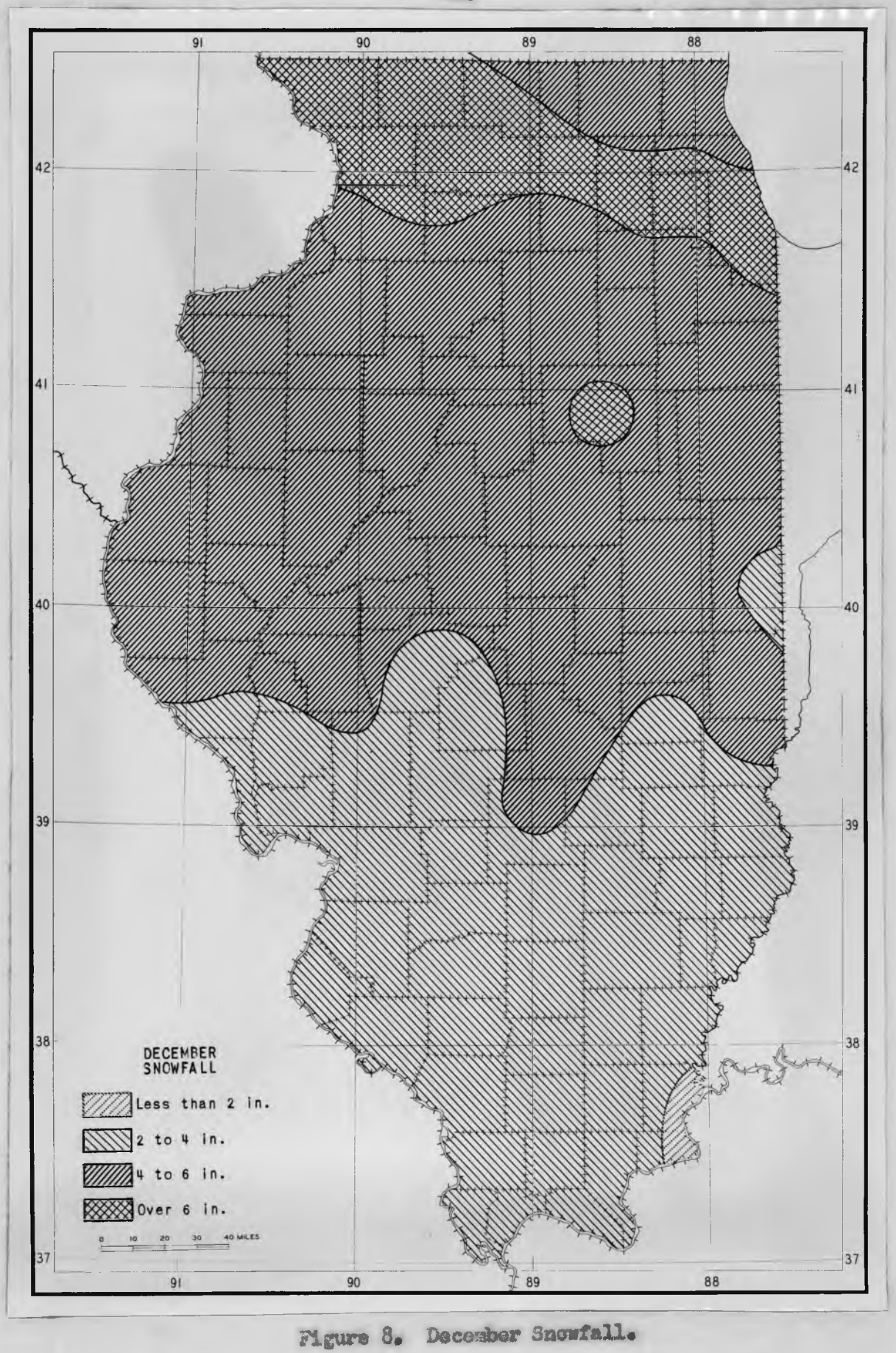


Figure 8. December Snowfall.

Michigan causing more of the precipitation to fall as rain in this region than in those farther west or south and away from the lake. The precipitation averages for December in this region do not show the same decrease as does the snowfall map. The small "island" of over 6 inches at Pontiac is for that single station and is the result of several high December values derived for the greater part from individual storms.

Rockford with 10 inches has the highest January average. (Fig. 9) The counties of the northwest all have over 8 inches, while there is slightly less just to the east of Rockford but the amount again increases to more than 8 inches along Lake Michigan. There is a gradual decrease southward to Shawneetown where the average is just under 2 inches.

The February map of snowfall (Fig. 10) has the most irregular pattern of all the monthly maps. The region of maximum snowfall is along the Lake Michigan shore, especially from Chicago southward. The lake effect, that is the increased cloudiness and showers caused by warming of the cold polar air mass in the lower layers with resulting increase in moisture and steepening of the temperature lapse rate, becomes even more pronounced in northern Indiana and southwest Michigan. The 4 inch snowfall line extends farthest south during this month than in any other and no station in the state has an average of less than 2.5 inches. Even though February is the shortest month, it is the one of maximum snowfall for the southern third of the state. The rather frequent occurrence of heavy snow storms in late February adds to the irregularity of the pattern for this month.

The distribution of snowfall over the state in March (Fig. 11) resembles that of January, except for the smaller amounts, the values varying from over 6 inches in the northwest to less than 2 inches in the extreme south. Temperature again appears as the most important control with much of the March precipitation occurring as rain rather than snow.

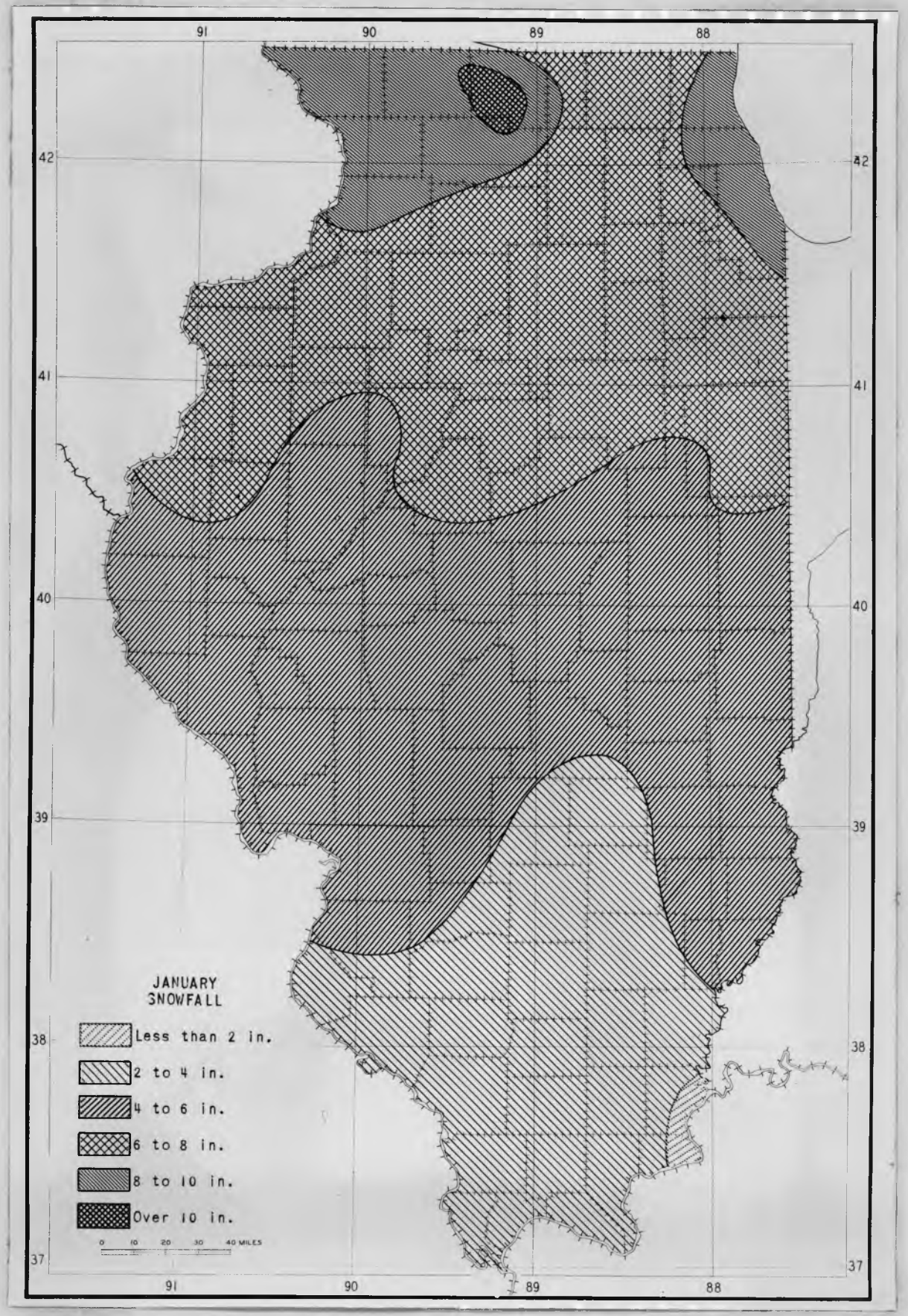


Figure 9. January Snowfall.

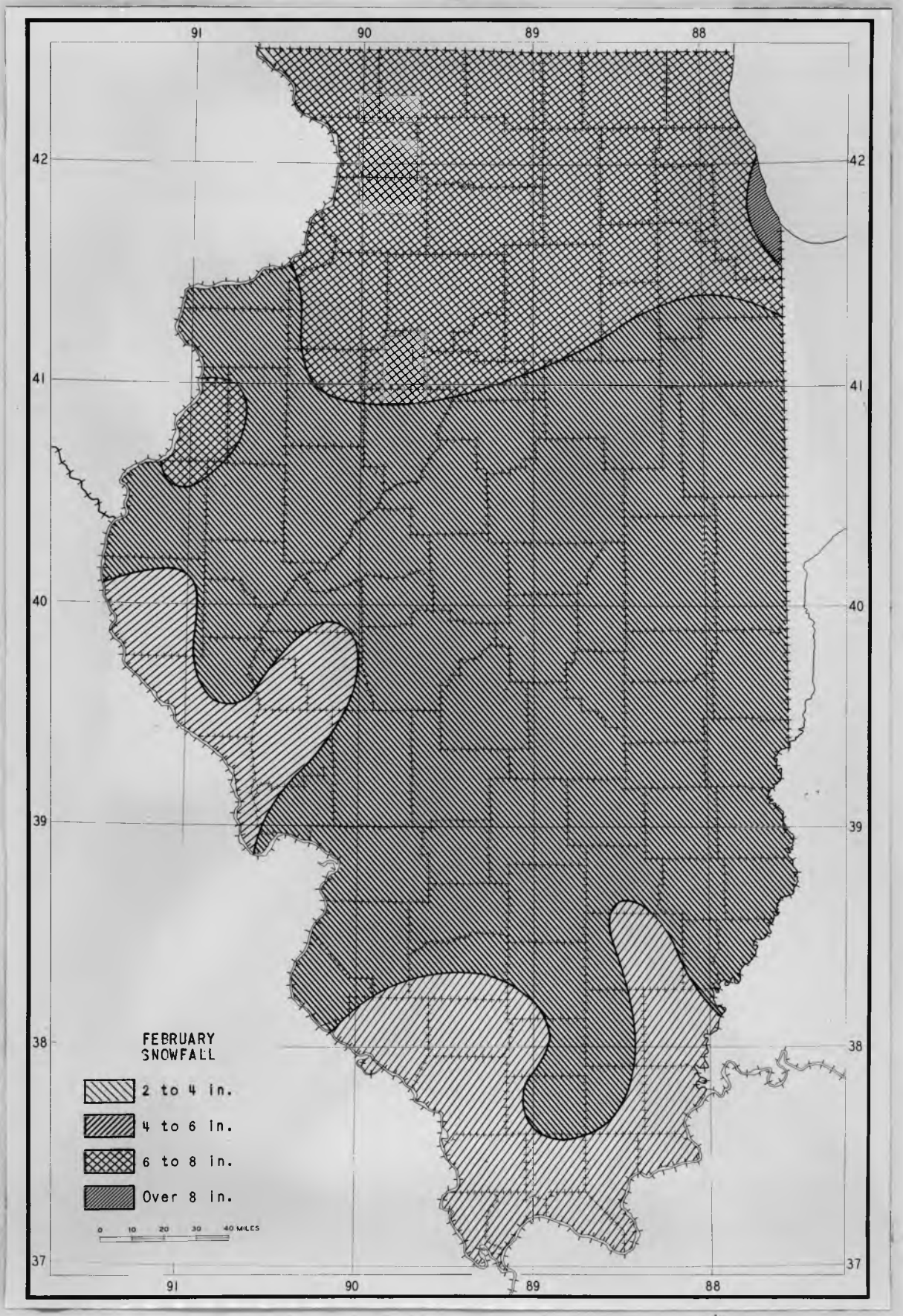


Figure 10. February Snowfall.

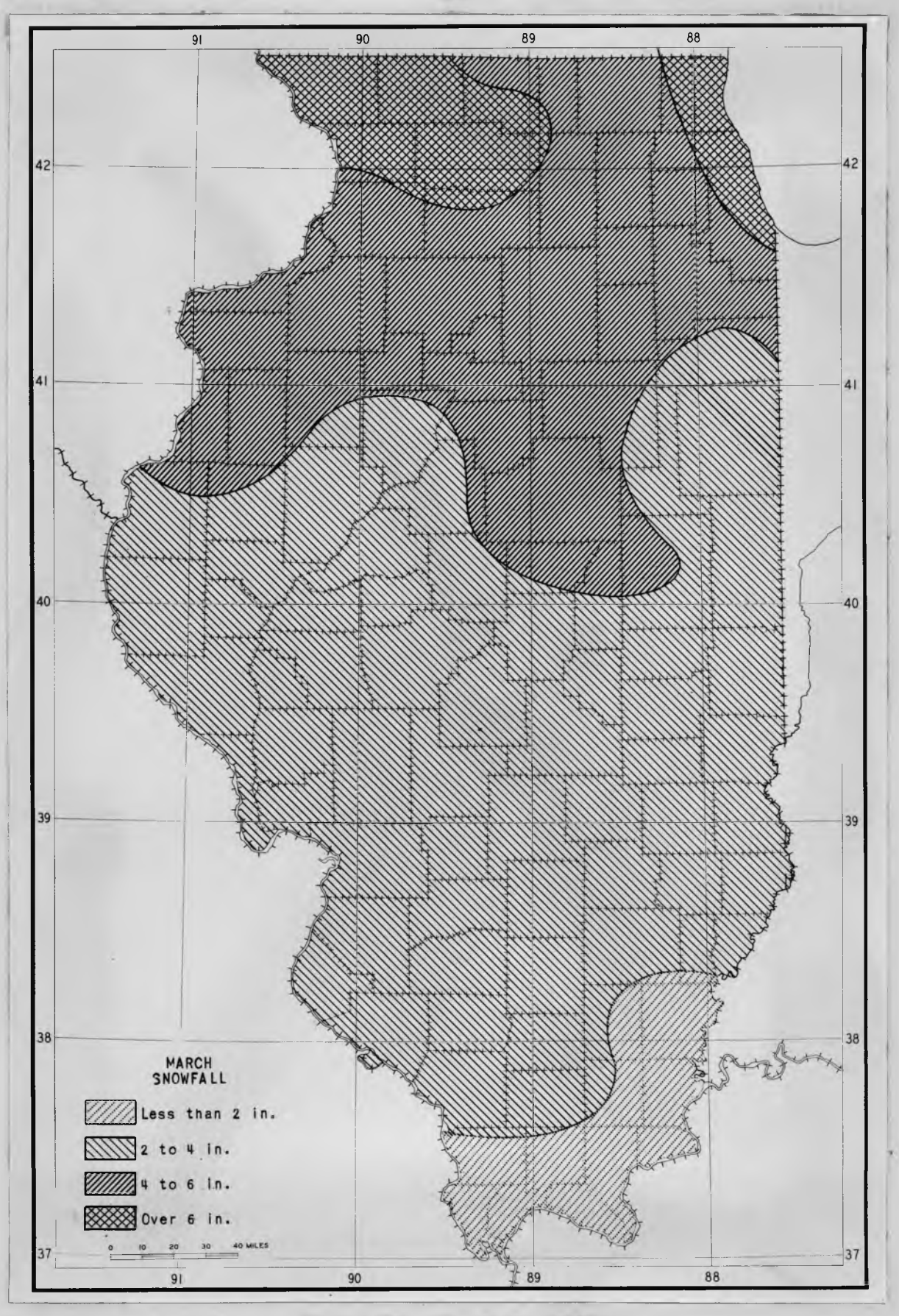


Figure 11. March Snowfall.

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For average monthly and annual, and maximum and minimum monthly snowfall for 59 stations in Illinois and adjacent states see Table I.

Figure 12 portrays the average number of days of snowfall over the state. A day of snowfall is considered to be any day in which a trace or more of snow is recorded regardless of how much snow falls or how long it remains on the ground. There is a rather regular increase in number of days from south to north with the actual maximum occurring in Chicago and along the Lake Michigan shores of Cook County. The isarithms are much smoother for this map. The intensity of snowfall within individual storms would not be indicated and many stations would have the same number of days of snowfall regardless of the variations in amount. Another reason for the smoothness is that there are fewer stations recording these data.

YEAR TO YEAR FLUCTUATION IN SNOWFALL

We are commonly told by our elders that our winters are moderating and that the snowfall is not nearly so great as it was in the past. It is unfortunate not to be able to positively prove or disprove such statements. Peoria has one of the older records for this state. It dates back to 1865 and shows the storm of February 27-28, 1900 (Fig. 4) to have given the heaviest snowfall for that area during the time of record. Snowfall of 18 to 20 inches was recorded in the area at that time. However, the Peoria Weather Bureau Office refers to the Historical Review, published in 1869, which says that two storms in the winter of 1830-31, December 29-30 and January 5 gave four feet of snow blocking the roads for two or three weeks.[1] Without official record such stories are difficult to verify, especially when one considers, as in the case noted above, that the storm described occurred 18 years previous to the publication. An attempt is made here to show

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1. United States Weather Bureau: Annual Meteorological Summary with Comparative Data, for, Peoria, 1947, p. 9.

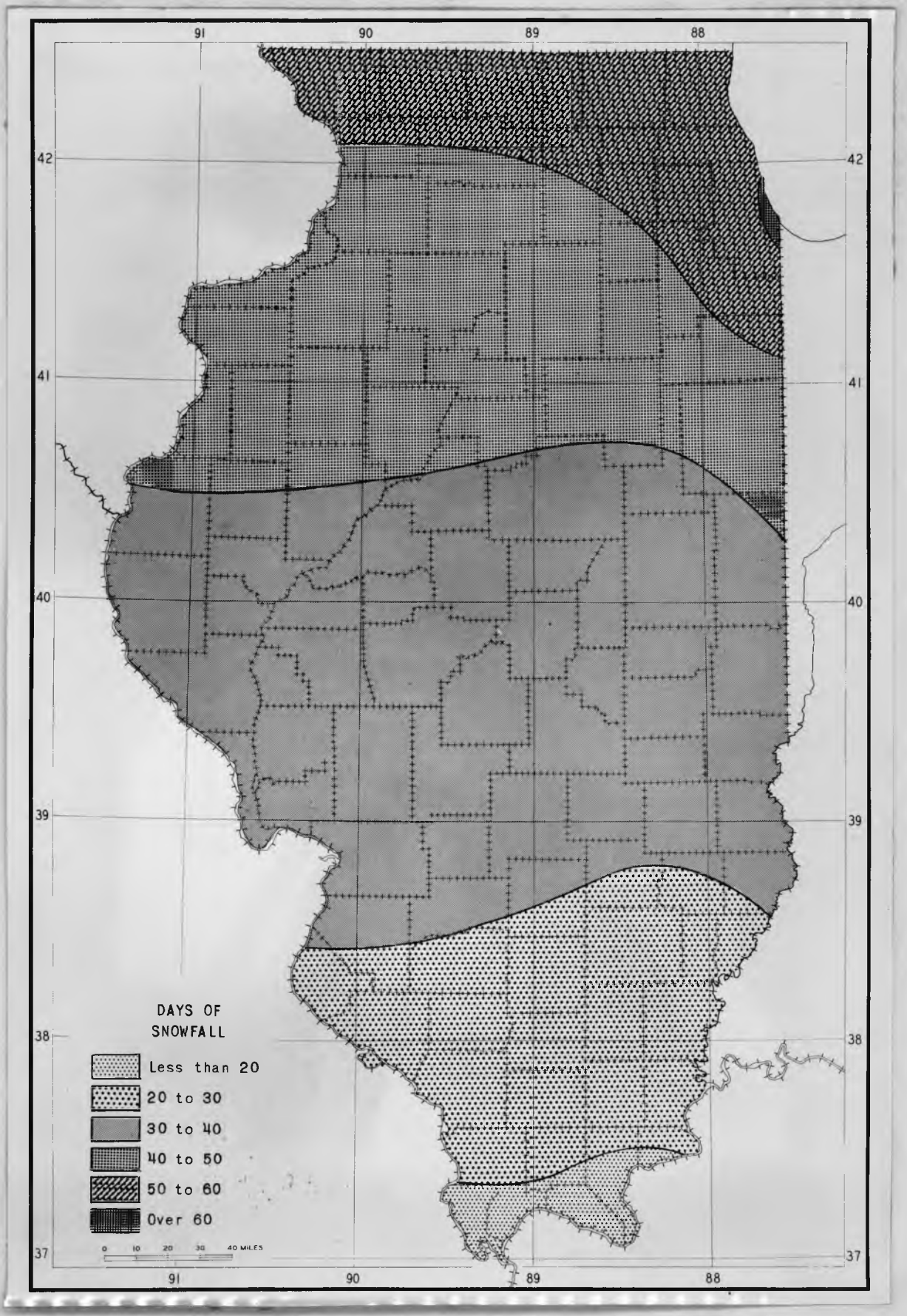

Figure 12. Annual number of days of snowfall.

TABLE 1

AVERAGE MONTHLY AND ANNUAL, AND MONTHLY MAXIMUM AND MINIMUM SNOWFALL

NORTHERN ILLINOIS

Station	Years of record		Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Aledo	47	Average	6.5	4.9	4.1	0.9	T	0	0	0	0	0.2	1.2	4.9	22.7
		Maximum	22.7	14.5	16.2	9.0	T	0	0	0	T	3.5	9.0	15.0	
		Minimum	T	T	0	0	0	0	0	0	0	0	0	0.3	
Aurora	52	Average	7.6	7.0	4.9	1.4	T	0	0	0	T	0.2	1.6	6.1	28.8
		Maximum	32.0	23.6	17.0	13.0	1.0	0	0	T	0.2	3.0	34.0	18.3	
		Minimum	T	T	0	0	0	0	0	0	0	0	0	0.5	
Davenport, Iowa	47	Average	6.7	5.9	4.6	0.8	T	0	0	0	0	0.2	1.4	4.9	24.5
		Maximum	16.8	16.8	24.8	7.8	0.1	0	0	0	0	2.2	12.8	16.3	
		Minimum	0.1	T	0	0	0	0	0	0	0	0	0	T	
Dixon	47	Average	7.9	6.7	6.2	1.4	T	0	0	0	T	0.2	2.1	6.2	30.7
		Maximum	26.5	17.8	26.5	15.5	T	0	0	0	T	4.5	16.5	17.0	
		Minimum	1.0	T	T	0	0	0	0	0	0	0	0	T	
Freeport	31	Average	8.9	5.9	6.3	1.5	0.1	0	0	0	0	0.6	2.4	6.6	32.3
		Maximum	20.8	17.7	27.5	14.0	2.4	0	0	0	T	7.0	11.0	18.0	
		Minimum	0.8	T	0	0	0	0	0	0	0	0	T	T	
Galva	52	Average	7.9	7.4	5.9	2.0	T	0	0	0	T	0.4	2.6	5.6	31.8
		Maximum	22.4	22.1	21.4	14.5	T	0	0	0	1.5	6.1	11.4	17.2	
		Minimum	0	0.1	0	0	0	0	0	0	0	0	0	0.5	

Station	Years of record		Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Henry	49	Average	7.1	6.2	5.0	0.9	T	0	0	0	T	0.1	1.5	4.9	25.7
		Maximum	20.2	21.0	18.0	8.9	T	0	0	0	0.3	1.5	9.5	20.5	
		Minimum	0.2	T	0	0	0	0	0	0	0	0	0	0	
Joliet	52	Average	6.9	6.6	4.9	1.3	0.1	0	0	0	T	0.2	2.4	5.6	28.0
		Maximum	21.2	22.4	17.3	11.0	4.5	0	0	0	1.0	3.0	17.2	17.0	
		Minimum	T	0	0	0	0	0	0	0	0	0	0	0.1	
Kankakee	31	Average	7.0	3.9	3.9	1.1	T	0	0	0	0.1	0.2	0.4	4.7	22.3
		Maximum	25.7	14.4	16.0	16.3	T	0	0	0	2.5	2.0	7.2	15.7	
		Minimum	T	T	0	0	0	0	0	0	0	0	0	T	
Marengo	48	Average	6.8	7.1	5.0	1.3	0.1	0	0	0	T	0.2	1.7	5.7	27.9
		Maximum	28.3	23.7	16.6	9.5	4.8	0	T	0	T	4.0	13.6	21.8	
		Minimum	T	T	T	T	0	0	0	0	0	0	0	T	
Minonk	51	Average	6.6	5.8	4.3	1.0	T	0	0	0	T	0.1	2.0	5.2	25.0
		Maximum	19.0	28.0	14.0	12.0	0.8	0	0	0	2.0	2.0	13.8	19.5	
		Minimum	T	0	0	0	0	0	0	0	0	0	0	T	
Morrison	46	Average	8.3	6.7	4.8	1.6	T	0	0	0	0	0.3	1.6	5.9	29.2
		Maximum	26.4	24.0	20.8	11.3	0.6	0	0	0	0.5	4.0	11.5	24.0	
		Minimum	0.7	0.3	0	0	0	0	0	0	0	0	0	T	
Monmouth	52	Average	7.3	6.0	4.4	1.4	T	0	0	0	T	0.2	1.7	4.9	25.9
		Maximum	23.2	18.0	17.2	9.0	0.3	0	0	0	1.1	3.2	11.1	16.5	
		Minimum	T	T	T	0	0	0	0	0	0	0	0	T	
Mt. Carrol	32	Average	9.9	7.3	7.1	1.9	0.1	0	0	0	0	0.4	2.8	6.9	36.4
		Maximum	31.0	23.4	24.8	13.6	2.0	0	0	0	0.1	5.0	13.1	21.2	
		Minimum	0.9	0.2	0	0	0	0	0	0	0	0	T	0.4	

Station	Years of record		Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Ottawa	50	Average	6.8	6.1	3.9	1.4	T	0	0	0	T	T	1.7	3.9	23.8
		Maximum	22.5	22.8	24.9	22.4	0.3	0	0	0	0.2	0.5	12.5	13.1	
		Minimum	T	T	T	0	0	0	0	0	0	0	0	T	
Paw Paw	16	Average	6.0	6.2	3.2	0.8	T	0	0	0	0	T	1.0	5.0	22.2
		Maximum	14.6	15.0	9.0	7.0	1.5	0	0	0	T	T	3.1	14.0	
		Minimum	0.5	0.8	T	0	0	0	0	0	0	0	0	T	
Pontiac	44	Average	8.1	5.9	4.4	1.1	T	0	0	0	T	0.2	1.6	6.5	27.8
		Maximum	29.0	15.0	15.0	11.0	0.5	0	0	0	2.5	4.0	8.5	22.0	
		Minimum	T	T	T	0	0	0	0	0	0	0	0	T	
Rockford	40	Average	10.3	7.2	6.6	1.2	T	0	0	0	0	0.3	2.5	6.2	34.3
		Maximum	36.1	21.8	23.5	9.0	1.5	0	0	0	T	5.0	14.8	26.6	
		Minimum	T	0.5	0	0	0	0	0	0	0	0	0	T	
Sycamore	52	Average	7.3	7.3	5.2	1.0	T	0	0	0	T	0.3	2.0	6.2	29.3
		Maximum	29.4	19.0	25.0	7.8	T	0	0	0	T	8.0	23.0	32.5	
		Minimum	0.3	T	0	0	0	0	0	0	0	0	0	T	
Walnut	52	Average	6.8	6.5	4.6	1.1	T	0	0	0	0	0.3	1.7	4.9	25.9
		Maximum	27.5	17.7	17.2	12.6	TT	0	0	0	T	6.3	10.1	22.6	
		Minimum	0.2	T	0	0	0	0	0	0	0	0	0	T	
Waukegan	25	Average	8.4	6.0	6.2	1.4	0.2	0	0	0	T	0.2	1.8	4.9	29.1
		Maximum	31.6	14.5	16.1	11.5	2.3	0	0	0	T	1.7	9.0	12.5	
		Minimum	T	1.1	0	0	0	0	0	0	0	0	0	T	

CENTRAL ILLINOIS

Station	Years of record		Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Bloomington	52	Average	6.2	5.4	4.6	0.9	T	0	0	0	T	0.3	1.5	4.9	23.8
		Maximum	26.2	27.5	16.3	10.5	T	0	0	0	0.4	5.0	10.5	15.2	
		Minimum	0	T	0	0	0	0	0	0	0	0	0	T	
Carlinville	52	Average	4.9	5.1	3.4	0.3	T	0	0	0	0	0.1	1.2	3.9	18.9
		Maximum	16.2	22.5	19.5	3.5	3.0	0	0	0	T	2.0	8.6	17.0	
		Minimum	0	0	0	0	0	0	0	0	0	0	0	T	
Charleston	51	Average	4.7	4.4	3.2	0.2	T	0	0	0	0	0.1	1.0	3.8	17.4
		Maximum	19.9	24.0	18.5	2.0	T	0	0	0	0	1.0	9.2	15.7	
		Minimum	T	0	0	0	0	0	0	0	0	0	0	0	
Danville	42	Average	5.3	4.2	3.5	0.4	T	0	0	0	0	0.2	1.4	3.7	18.7
		Maximum	19.5	18.9	13.7	4.0	T	0	0	0	T	4.2	11.0	18.7	
		Minimum	0	0.1	0	0	0	0	0	0	0	0	0	0	
Decatur	52	Average	5.6	4.7	3.7	0.5	0.1	0	0	0	0	0.2	1.4	4.3	20.4
		Maximum	20.5	18.0	30.5	11.0	4.0	0	0	0	T	4.0	8.3	14.0	
		Minimum	T	T	0	0	0	0	0	0	0	0	0	T	
Effingham	38	Average	3.4	3.2	2.3	0.1	0	0	0	0	0	T	0.9	3.9	13.6
		Maximum	14.5	11.0	11.0	2.5	T	0	0	0	0	0.2	6.0	15.5	
		Minimum	0	T	0	0	0	0	0	0	0	0	0	0	
Fairview	17	Average	5.2	5.2	3.8	1.2	T	0	0	0	T	0.1	1.1	4.7	21.3
		Maximum	13.3	11.7	14.6	10.0	1.0	0	0	0	2.5	1.7	5.0	12.5	
		Minimum	T	T	0	0	0	0	0	0	0	0	0	T	

Station	Years of record		Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Griggsville	50	Average	5.4	5.0	4.0	0.8	T	0	0	0	0	0.2	1.4	4.2	21.0
		Maximum	17.6	30.8	20.2	11.0	T	0	0	0	T	3.0	13.0	16.3	
		Minimum	T	T	0	0	0	0	0	0	0	0	0	T	
Havana	52	Average	6.0	4.5	4.0	0.7	T	0	0	0	0	0.2	1.1	4.3	20.8
		Maximum	22.9	14.2	20.5	11.5	T	0	0	0	T	3.5	9.7	15.2	
		Minimum	T	T	0	0	0	0	0	0	0	0	0	T	
Hillsboro	52	Average	4.3	4.6	3.0	0.3	T	0	0	0	0	T	0.7	3.8	16.7
		Maximum	16.0	22.0	22.7	T	5.0	0	0	0	0	1.8	7.3	18.0	
		Minimum	0	T	0	0	0	0	0	0	0	0	0	0	
Hoopston	42	Average	6.3	5.5	3.7	1.1	0.1	0	0	0	0	0.2	1.8	5.5	24.2
		Maximum	18.0	31.9	15.0	12.0	2.5	0	0	0	T	3.5	12.0	18.6	
		Minimum	T	T	0	0	0	0	0	0	0	0	0	T	
Jacksonville	21	Average	6.1	3.2	3.6	0.3	T	0	0	0	0	0.1	1.4	5.0	18.7
		Maximum	15.5	8.5	12.5	4.0	T	0	0	0	T	3.0	7.0	16.0	
		Minimum	0	T	T	0	0	0	0	0	0	0	0	T	
La Harpe	52	Average	6.9	6.1	4.9	1.1	T	0	0	0	T	0.4	1.6	5.1	26.1
		Maximum	27.0	30.5	18.0	12.0	1.5	0	0	0	3.1	9.0	8.0	17.2	
		Minimum	T	T	0	0	0	0	0	0	0	0	0	T	
Lincoln	40	Average	5.6	4.3	3.9	0.6	T	0	0	0	T	0.2	1.5	5.2	21.3
		Maximum	18.3	24.0	21.0	7.8	T	0	0	0	T	2.8	8.0	21.5	
		Minimum	0	T	T	0	0	0	0	0	0	0	0	T	
Palestine	50	Average	4.2	4.2	2.2	0.2	T	0	0	0	0	T	0.4	3.5	14.7
		Maximum	18.5	19.5	14.5	6.0	T	0	0	0	T	0.5	5.0	14.0	
		Minimum	T	T	0	0	0	0	0	0	0	0	0	0	

Station	Years of record		Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Pana	49	Average	4.6	4.6	2.6	0.2	0.1	0	0	0	0	0.1	0.9	4.0	17.1
		Maximum	16.9	16.0	15.5	3.0	2.5	0	0	0	0	2.0	9.0	16.3	
		Minimum	0	0	0	0	0	0	0	0	0	0	0	T	
Paris	50	Average	4.8	4.1	3.2	0.2	T	0	0	0	0	T	1.2	4.9	18.4
		Maximum	29.0	16.3	14.8	4.0	T	0	0	0	0	0.1	10.0	17.0	
		Minimum	T	0	0	0	0	0	0	0	0	0	0	0	
Quincy	36	Average	5.3	3.9	3.5	1.1	T	0	0	0	0	0.1	1.0	4.5	19.4
		Maximum	17.3	16.9	17.5	13.0	T	0	0	0	0	3.6	5.5	17.0	
		Minimum	0	T	0	0	0	0	0	0	0	0	0	T	
Roberts	20	Average	5.4	4.3	2.9	0.6	0	0	0	0	T	T	1.4	4.6	19.2
		Maximum	13.3	7.6	10.7	4.0	T	0	0	0	1.0	T	9.3	13.2	
		Minimum	T	1.2	T	0	0	0	0	0	0	0	0	T	
Rushville	49	Average	5.6	4.1	3.6	1.0	T	0	0	0	0	0.3	1.0	4.5	20.1
		Maximum	14.5	21.0	17.5	18.0	T	0	0	0	0	4.0	8.4	14.8	
		Minimum	T	T	0	0	0	0	0	0	0	0	0	0	
White Hall		Average	3.9	3.1	2.6	0.3	T	0	0	0	0	0.1	1.0	3.7	14.7
		Maximum	9.5	12.5	10.7	6.2	T	0	0	0	0	1.0	13.5	12.1	
		Minimum	0	T	0	T	0	0	0	0	0	0	0	T	
SOUTHERN ILLINOIS															
Anna	34	Average	3.2	3.0	1.4	T	T	0	0	0	0	T	0.3	2.5	10.4
		Maximum	22.0	12.5	9.5	0.7	T	0	0	0	0	T	4.0	16.7	
		Minimum	0	0	0	0	0	0	0	0	0	0	0	0	

Station	Years of record		Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Carbondale	38	Average	3.5	3.9	2.5	0.1	T	0	0	0	0	0.1	0.5	2.8	13.4
		Maximum	25.3	14.3	16.9	3.0	T	0	0	0	0	4.0	6.5	12.8	
		Minimum	0	0	0	0	0	0	0	0	0	0	0	0	
Davenport	47	Average	6.7	5.9	4.6	0.8	T	0	0	0	0	0.2	1.2	4.9	24.3
		Maximum	17.7	17.7	24.8	7.8	0.1	0	0	0	T	2.2	10.8	16.3	
		Minimum	0.1	0.5	0	0	0	0	0	0	0	0	0	T	
Duquoin	39	Average	3.2	3.6	1.9	0.1	T	0	0	0	0	0.1	0.4	2.7	12.0
		Maximum	26.0	16.8	16.5	4.0	1.0	0	0	0	0	5.0	4.7	15.0	
		Minimum	0	0	0	0	0	0	0	0	0	0	0	0	
Fairfield	38	Average	3.6	3.9	2.1	0.2	T	0	0	0	0	0.1	0.4	2.9	13.2
		Maximum	19.6	19.5	12.0	4.0	T	0	0	0	0	3.5	4.0	14.7	
		Minimum	0	0	0	0	0	0	0	0	0	0	0	0	
Flora	50	Average	3.1	4.0	2.2	0.2	T	0	0	0	0	0.1	0.5	3.0	13.1
		Maximum	21.4	19.0	14.0	2.2	T	0	0	0	0	1.5	7.5	10.7	
		Minimum	0	0	0	0	0	0	0	0	0	0	0	0	
Golconda	23	Average	2.7	2.5	1.9	0.2	T	0	0	0	0	T	0.1	2.6	10.0
		Maximum	17.0	9.4	11.5	5.5	T	0	0	0	0	T	1.0	7.0	
		Minimum	0	T	0	0	0	0	0	0	0	0	0	0	
Harrisburg	28	Average	2.9	4.1	2.0	T	T	0	0	0	0	0.2	0.7	2.4	12.3
		Maximum	12.5	14.1	7.3	0.9	T	0	0	0	0	6.2	6.0	8.9	
		Minimum	0	0	0	0	0	0	0	0	0	0	0	0	
Louisiana, Mo.	33	Average	5.4	4.0	4.2	0.7	T	0	0	0	0	0.1	1.1	4.3	19.8
		Maximum	19.0	15.4	25.6	10.4	T	0	0	0	0	2.0	12.1	14.5	
		Minimum	0	T	0	0	0	0	0	0	0	0	0	0.1	

Station	Years of record		Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
McLeansboro	52	Average	3.6	3.9	2.0	0.3	T	0	0	0	0	0.1	0.6	2.9	13.4
		Maximum	25.0	14.0	13.5	5.0	T	0	0	0	0	6.5	5.8	13.2	
		Minimum	0	0	0	0	0	0	0	0	0	0	0	0	
Mascoutah	50	Average	4.5	5.5	3.1	0.3	T	0	0	0	0	T	0.7	3.7	17.8
		Maximum	16.0	22.5	28.0	6.0	1.9	0	0	0	0	0.4	4.6	12.8	
		Minimum	0	T	0	0	0	0	0	0	0	0	0	0	
Mt. Carmel	38	Average	4.7	4.3	2.4	0.1	T	0	0	0	0	0.1	0.4	3.5	15.5
		Maximum	32.0	22.5	17.0	2.5	T	0	0	0	0	4.0	2.5	19.0	
		Minimum	0	0	0	0	0	0	0	0	0	0	0	0	
Olney	52	Average	4.8	4.8	3.1	0.3	T	0	0	0	0	0.1	0.7	4.2	18.0
		Maximum	24.5	18.5	21.2	6.0	1.7	0	0	0	0	2.2	5.3	12.4	
		Minimum	T	0	0	0	0	0	0	0	0	0	0	0	
Salem	15	Average	3.6	4.8	3.0	0.2	T	0	0	0	0	0	0.5	3.9	16.0
		Maximum	9.7	12.1	10.9	2.1	0.7	0	0	0	0	T	2.9	11.2	
		Minimum	0	T	0	0	0	0	0	0	0	0	0	T	
Shawneetown	15	Average	1.9	3.5	0.1	T	0	0	0	0	0	T	0.3	1.9	7.7
		Maximum	11.0	10.9	13.0	T	0	0	0	0	0	T	4.0	8.0	
		Minimum	T	0	0	0	0	0	0	0	0	0	0	0	
Sparta	37	Average	3.4	3.3	3.1	0.1	0	0	0	0	0	T	0.6	3.2	13.7
		Maximum	16.4	18.5	25.4	2.8	T	0	0	0	0	1.0	4.5	9.5	
		Minimum	0	0	0	0	0	0	0	0	0	0	0	0	
Waterloo	11	Average	3.4	5.5	4.8	T	0	0	0	0	0	T	0.6	4.9	19.2
		Maximum	12.5	10.2	13.5	0.5	0	0	0	0	0	T	3.3	11.5	
		Minimum	0	0.2	0	0	0	0	0	0	0	0	0	0	

whether any long period trends exist by plotting graphs made of sliding five year averages.[1] Five year averages were chosen with the thought that a shorter period average would overemphasize individual years or storms while longer averages, say 10 years, would tend to smooth out and hide the unusual individual influences.

In an attempt to reveal the many differences in snowfall in Illinois, seven stations were selected to be graphed on a five year sliding average. During certain years or groups of years the amounts were so nearly the same for the different stations that it became necessary to use two graphs. The selection of stations was made with the idea of reflecting the differences from north to south as well as west to east. In the first graph (Fig. 13) the stations of Dubuque, Peoria, Terre Haute, and Cairo are used, while in the other Chicago, Springfield, St. Louis, and Cairo are considered.

The most striking feature of the graphs is the amount of variance and lack of symmetry. Dubuque has four definite peaks shown as of the entires for 1898-99, 1909-10, 1927-28, and 1941-42. It should be remembered that each of the years shown is the middle year of the five year period. Therefore, the 1941-42 value is the average of the five years from 1939-40 through 1943-44. In this peak, the amount of 39.2 inches is as high as the average of any of the five year groups in the fifty-four year record and represents a time in which four of the five years considered had above average snowfall. In contrast to this, the peak represented by the 1909-10 mid-five year value is equally high but is the result of

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1. To construct sliding five year averages the first five yearly values were averaged and that value given for the middle or third year. The next 5 year value is computed by dropping the value for the first year and adding the value for the next or sixth year, and finding the mean for those 5 years. The new 5 year mean is assigned to the middle year of the group. This process is continued until the whole record is accomplished. A graphical representation is presented by plotting the 5 year values on rectangular coordinates, using time in years as the abscissa and inches of snowfall as the ordinate.

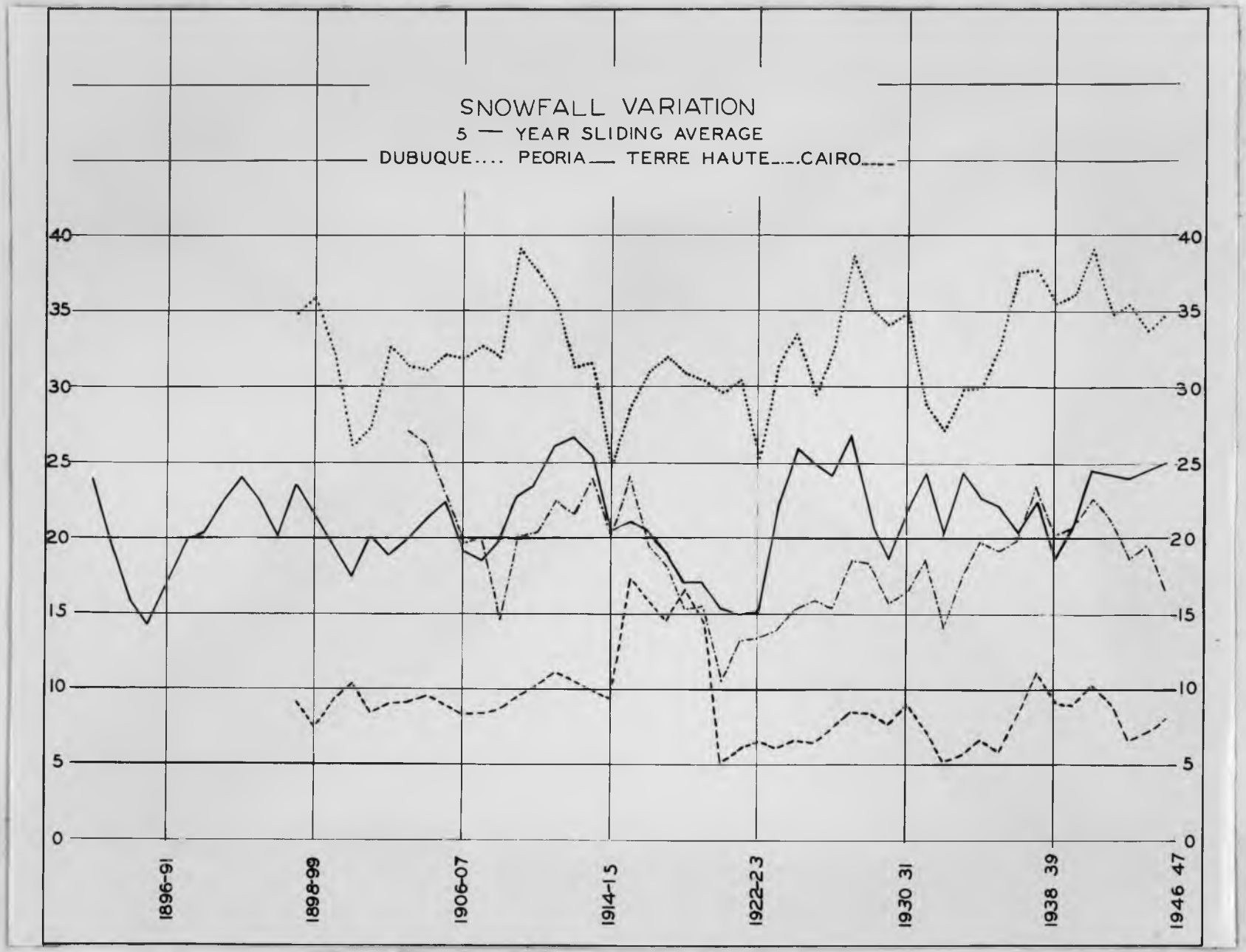

Figure 13. Snowfall variations over the years.

only two very snowy years,[1] (1909-10 and 1911-12) and three other years that actually had below normal snowfall amounts. Four definite minimum periods are indicated with the period of lowest five year snowfall occurring through 1912-13 to 1916-17. During that time only one year of the five had as much as the average amount of snow and indicates a definite period of decreased snowfall. The next marked dip in the Dubuque graph occurs at the 1922-23 mid-value. This dip is due primarily to the light snowfall of 1924-25 which had only 11.0 inches and is the lowest value of the whole record. The following year had 56 inches and is the greatest amount recorded in a single year. This is to say then that the low value given for the 1922-23 dip on the chart reflects an extreme year rather than a period of snowfall. While it is true there are four peak values and four obvious low points there is little relation in time between the peaks or between the low points or in the time between the peaks and the following low points.

The Peoria curve reveals as much irregularity as the one for Dubuque but no striking similarity to it. Even though Peoria has a longer record than Dubuque only two definite periods of heavy snowfall are indicated and only one of these occurs simultaneously with a Dubuque maximum. The highest five year value for Peoria was recorded for the period from 1925-26 to 1929-30 and contains the 44 inches for the year 1925-26, the highest annual value ever observed for that station. Any of the five year periods including that year will necessarily be influenced by that single high figure and will tend to show above average snowfall. The peak indicated by the 1912-13 mid-value was an actual period of greater snowfall in which five consecutive years had above normal amounts recorded but no single year was abnormally high. The time of least snowfall for Peoria was

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1. Hereafter when year is mentioned, it will refer to the last half of one and the first half of the succeeding year rather than a calender year.

was in the late 1880's rather than in the 1930's or 1940's as some "old timers" might have us believe. The five year period from 1887-88 to 1901-02 was a period of real snowfall deficit, with each of the five years having only 60 to 78 per cent of the normal amount. The second period of extremely low values was from 1920-21 to 1925-26 in which all years were sub normal and the winter of 1920-21 had the record low of only 8.6 inches. The amount of snowfall in the early and middle 1940's has only been surpassed in two other periods of similar length since 1886.

Observations at Terre Haute were begun in 1901 at Indiana State College, at a time when the amounts were greater than they have been at any time since. Actually the first winter of this peak period was well below normal with only 10.3 inches but the third and fifth winters had the highest values of the entire record and were the results primarily of two storms, one in January of 1904 and the other in March of 1906. It is easy to see how if averages were published then, representing a short record, were compared with averages published forty-five years later that one could incorrectly deduce a marked change toward decreasing snowfall amounts. The peak at the beginning period at Terre Haute is not reflected in any of the other three stations. The minimum value falls at the 1920-21 mid-five year value and represents five years of low snowfall amounts, including the absolute minimum of 4.9 inches which fell in the 1919-20 winter. The 1920-21 mid-value, likewise, represents the minimum for Cairo, St. Louis and Springfield and shows with little doubt that it was a period of light snowfall for all of southern and central Illinois.

Cairo, having low averages, shows less fluctuations and the steadiest conditions of any of the stations shown on either Fig. 13 or Fig. 14. The exception to this is the peak period shown by entries for 1915-16 to 1920-21. This again was not so much a period of heavy snowfall but rather one extreme season, 1917-18

which gave Cairo 47.7 inches of snow and was severe enough that it must have caused some of the "old timers" to wonder if the seasons were getting worse.

The graphs appearing as Fig. 14, like Fig. 13, shows the extreme amount of variation that does occur in the five year periods but fails to clearly indicate any permanent trend toward more or less snowfall. St. Louis comes closer to indicating a trend than any other station. A rather marked and continued increase is shown from the beginning of the record up to around 1910 to 1915. This is followed by a decline of varying degrees of intensity even to the present. The peak period of 1910-11 to 1914-15 contains the all-time record of 67.6 inches which occurred in the winter of 1911-12 and the 43.2 inches of 1913-14. Both of these winters were preceded and followed by winters of normal or below normal snowfall. It can also be noted that this peak period was not coincident with the maxima of the other stations and is the only time in which St. Louis recorded more snow than Terre Haute. The best correlation of any two stations is shown for St. Louis and Terre Haute through the 1920's and 1930's. During the warm winter of 1931-32, St. Louis recorded only 0.7 of an inch of snow. It may well be that the St. Louis data suggests that this area is in a marginal zone rather than suggesting any long term change involved, a zone such that any of the controls, whether latitude, continentality, individual storms, storm track, or air masses involved can in any one season exert its affects more strongly or for a greater period of time.

Chicago shows two periods of heavy snowfall, the middle 1890's and the late 1920's, and two periods of light snowfall. The most definite period of low snowfall was the early 1920's, a period of generally light snow for the whole state, except the area near Dubuque. Twenty-seven of the 58 mid-values plotted gives higher values for Dubuque than Chicago. Chicago and Dubuque have nearly the same average annual snowfall but a perusal of the two curves, or of the actual data shows little in the way of striking similarity of contrast on a year to year basis.

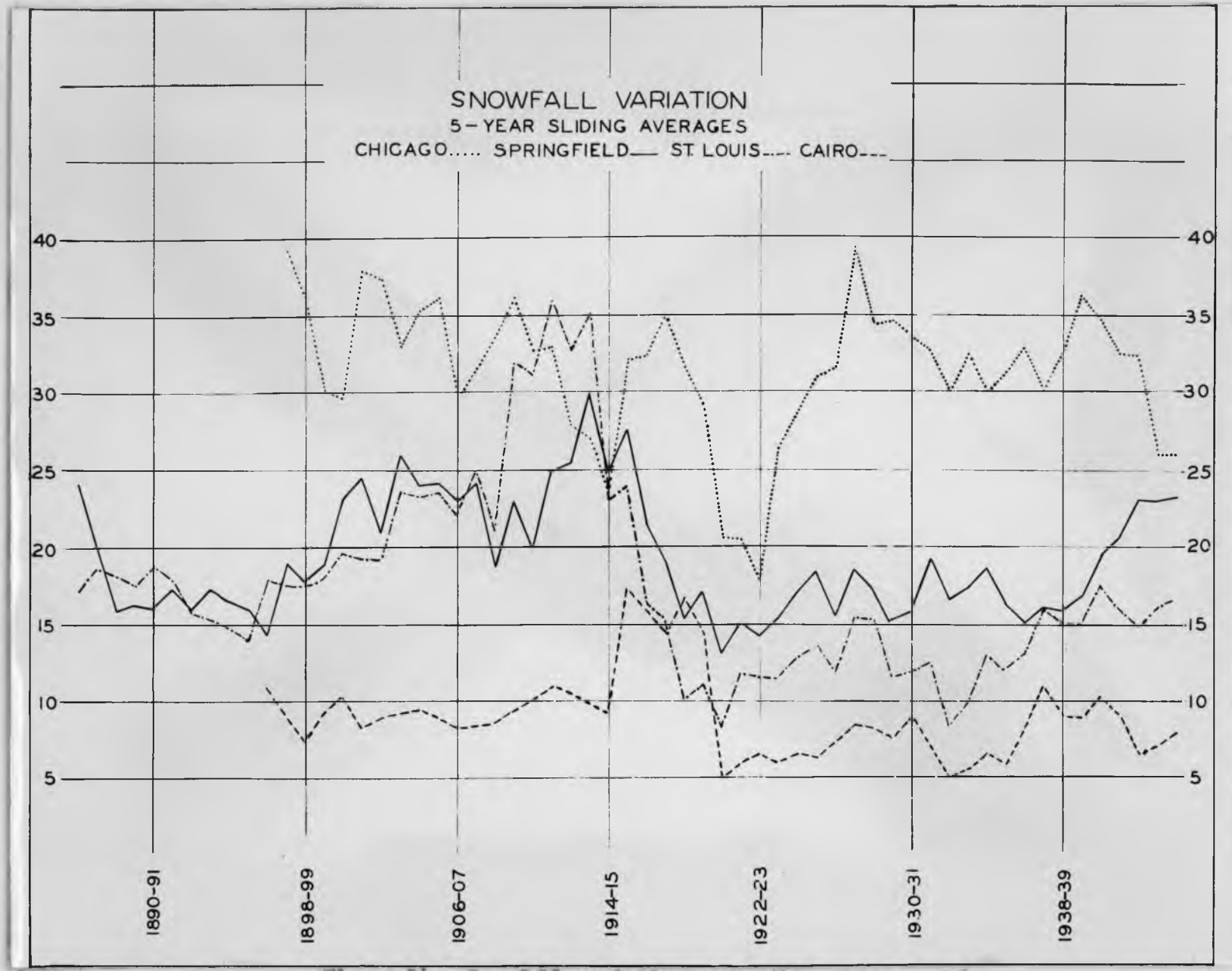

Figure 14. Snowfall variations over the years.

It may be added that the effect of the Great Lakes on precipitation in general is to greatly increase the number of days of precipitation but to increase total precipitation only slightly, if any. Springfield had a period of heavy snowfall beginning about 1910 and two periods of light snow, occurring in the 1890's and the early 1920's. The highest five year average was that entered for the 1913-14 mid-value. Four of the five years had above normal snowfall and the 43 inches of 1913-14 is the highest of the 63 year record. The season following this five year period had only 6.2 inches, the lowest on record, and was responsible for the sharp dip in the curve for the 1914-15 value. Except for the period of generally light snowfall in the early 1920's there is little similarity between Springfield and Peoria other than at the beginning and ending of the two curves. Cairo had, as is to be expected, little snow throughout its record with the periods of light snow being less conspicuous than the peak period caused by the 47.7 inches of snow that fell in the severe 1917-18 winter.

Snowfall by months and years, from the beginning of the records through 1947 for thirteen selected stations in Illinois and adjoining states, appear as Table 2.

SNOW COVER AND LOW TEMPERATURES

A snowy winter is often presumed to be a cold one although this is not necessarily the case. However, the lack of snow is often one of the results of a mild winter. A snow cover often has a pronounced effect on air temperatures. Snow is a poor conductor of heat and insulates the air from the heat that might otherwise be radiated to it from the earth. At the same time the snow surface itself becomes increasingly colder since 70 to 90 per cent of the insolation reaching it is reflected and the heat it contains is lost rapidly by radiation. Thus the severest cold waves usually are associated with a snow cover as are local

TABLE 2.

MONTHLY AND ANNUAL SNOWFALL

DUBUQUE

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1895	14.0	6.0	1.0	0	0	0	0	0	0	0	8.7	1.8	46.1
1896	5.0	13.0	2.6	2.1	0	0	0	0	0	T	T	3.8	26.5
1897	9.2	10.0	5.1	T	0	0	0	0	0	0	T	14.8	39.1
1898	15.1	18.5	5.1	T	0	0	0	0	0	3.6	2.9	1.3	46.5
1899	3.3	6.1	6.1	T	0	0	0	0	0	0	T	3.5	19.0
1900	4.9	12.9	10.8	3.5	0	0	0	0	0	0	4.3	2.4	38.8
1901	9.0	11.3	12.0	T	0	0	0	0	0	0	4.9	3.0	40.2
1902	8.3	2.9	1.4	T	0	0	0	0	0	0	T	12.1	24.7
1903	1.5	6.2	2.6	T	0	0	0	0	0	0	0.4	9.2	19.9
1904	4.8	6.2	8.0	1.5	0	0	0	0	0	0	T	15.5	36.0
1905	9.6	16.6	9.3	0.2	0	0	0	0	0	0	T	9.6	45.3
1906	7.5	7.7	6.4	1.0	0	0	0	0	0	T	4.4	0.6	27.6
1907	4.4	6.8	1.9	1.6	T	0	0	0	0	0	2.1	3.8	20.6
1908	7.9	13.6	T	0.1	0	0	0	0	0	0	0.1	4.9	26.6
1909	10.0	6.9	4.7	1.7	0.3	0	0	0	0	0.1	3.5	17.7	44.9
1910	22.1	4.6	T	7.6	0	0	0	0	0	0.1	1.7	5.1	41.2
1911	6.7	7.7	1.1	5.4	T	0	0	0	0	0.5	2.9	7.4	31.7
1912	5.8	18.0	16.7	5.0	0	0	0	0	0	0	0.1	0.4	46.0
1913	9.0	4.9	5.0	0.2	0	0	0	0	0	0.2	T	T	19.3
1914	6.7	11.5	0.9	T	0	0	0	0	0	T	T	14.6	33.7
1915	5.0	5.6	8.5	T	0	0	0	0	0	T	2.8	2.0	23.9
1916	7.4	7.4	8.9	T	0	0	0	0	0	0	1.1	6.0	30.8
1917	8.4	1.7	2.5	1.4	1.0	0	0	0	0	3.2	0.5	8.0	26.7
1918	17.5	5.3	1.4	3.4	0	0	0	0	0	T	2.0	10.7	40.3
1919	2.3	13.5	3.0	0.1	0	0	0	0	0	0	1.4	12.6	32.9
1920	11.5	6.7	5.6	0.3	0	0	0	0	0	0.1	1.4	5.6	31.2
1921	3.0	2.9	T	10.1	0	0	0	0	0	T	7.0	3.8	26.8
1922	2.8	2.1	3.8	T	0	0	0	0	0	0	1.2	3.4	13.3
1923	4.5	4.8	20.8	1.0	T	0	0	0	0	1.4	3.0	7.3	42.8
1924	4.3	8.6	10.1	0.8	0	0	0	0	0	0	0.6	3.5	27.9
1925	1.2	2.7	3.0	0	T	0	0	0	0	3.9	11.0	10.2	32.0
1926	7.4	7.8	12.9	2.8	0	0	0	0	0	0.4	8.2	4.8	44.3
1927	4.9	3.4	2.7	4.8	0	0	0	0	0	T	1.4	3.3	20.5
1928	0.7	3.0	3.7	3.5	0	0	0	0	0	0	4.5	0.9	13.6
1929	34.3	8.0	2.7	0.2	T	0	0	0	0	3.0	0.7	6.3	48.0
1930	21.1	3.6	5.4	2.0	0	0	0	0	0	T	3.3	7.6	43.0

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1931	7.9	1.4	18.1	T	0	0	0	0	0	0	T	5.7	33.1
1932	3.1	0.4	14.5	T	0	0	0	0	0	0.9	0.8	2.7	22.4
1933	1.1	5.2	7.8	1.4	0	0	0	0	0	0	2.7	6.2	24.4
1934	1.8	6.9	1.8	0.4	0	0	0	0	0	0	T	7.3	18.2
1935	7.1	9.2	8.8	T	1.3	0	0	0	0	0	1.0	8.9	36.3
1936	15.5	17.8	3.0	5.7	0	0	0	0	0	0	2.9	4.8	49.7
1937	3.2	8.3	4.7	0.2	0	0	0	0	0	0.3	5.9	9.1	31.7
1938	6.3	1.6	5.6	5.7	T	0	0	0	0	T	5.7	7.3	32.2
1939	5.6	13.3	11.8	T	0	0	0	0	0	T	T	T	30.7
1940	17.2	9.9	5.8	1.5	T	0	0	0	0	0	4.7	6.5	45.6
1941	8.0	3.5	18.5	0	0	0	0	0	0	0	T	12.1	42.1
1942	10.9	3.9	0.3	0	0	0	0	0	T	T	5.8	8.7	29.6
1943	25.7	3.9	5.6	T	0	0	0	0	0	T	T	0.2	35.4
1944	3.3	6.3	7.8	0.6	T	0	0	0	0	0	3.0	14.8	35.8
1945	10.6	9.8	T	T	T	0	0	0	0	0	9.6	6.9	36.9
1946	2.4	4.3	7.9	T	0	0	0	0	0	0	T	4.2	18.8
1947	22.9	3.5	0.4	3.0	T	0	0	0	0	0	10.2	4.0	44.0
Ave.	8.6	6.8	6.2	1.5	T	0	0	0	0	0.3	2.6	6.5	32.5

BELOIT

1897	....	6.7	8.0	0	0	0	0	0	0	0	2.2	7.7	24.6
1898	16.7	14.0	3.5	0	0	0	0	0	0	3.0	4.2	2.2	43.6
1899	3.0	....	4.0	T	0	0	0	0	0	0	0	.7	7.7
1900	....	11.0	7.5	6.0	0	0	0	0	0	0	3.2	5.0	32.7
1901	10.2	16.9	5.5	T	0	0	0	0	0	0	0	....	32.6
1902	6.0	....	T	0	0	0	0	0	0	0	0	....	6.0
1903	....	2.3	T	0	0	0	0	0	0	T	0.7	21.0	24.0
1904	11.5	7.0	T	0	0	0	0	0	0	0	0	15.2	33.7
1905	4.7	12.3	11.0	1.1	0	0	0	0	0	0	T	3.0	32.1
1906	6.2	3.4	6.0	0	0	0	0	0	0	T	T	....	15.6
1907	5.5	5.8	0.8	0	1.0	0	0	....	0	0	1.0	....	14.1
1908	6.7	17.4	....	T	0	0	0	0	0	0	0	4.0	28.1
1909	....	6.0	2.0	....	0	0	0	0	0	0	2.0	31.4	41.4
1910	....	T	T	4.0	0	0	0	0	0	T	T	9.5	13.5
1911	6.6	7.3	0.3	4.3	0	0	0	0	0	0.5	7.5	7.5	34.0
1912	5.2	5.0	12.8	8.0	0	0	0	0	0	0	1.0	1.0	33.0
1913	6.0	6.0	5.0	0	0	0	0	0	0	1.0	T	T	18.0
1914	....	....	T	T	0	0	0	0	0	T	T	13.2	13.2
1915	4.8	1.8	7.5	0	0	0	0	0	0	0	1.5	2.1	17.7

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1916	4.5	7.5	6.0	0	0	0	0	0	0	0	0.8	2.2	21.0
1917	7.0	1.2	0.8	T	0	0	0	0	0	5.0	T	6.8	20.8
1918	37.0	4.5	1.5	T	0	0	0	0	0	0	T	5.5	48.5
1919	3.0	4.7	....	0	0	0	0	0	....	0	0.7	11.5	22.9
1920	9.2	3.5	1.0	T	0	0	0	0	0	0	T	4.0	17.7
1921	2.5	0.5	....	11.0	0	0	0	0	0	0	1.7	3.0	18.7
1922	....	0.5	1.5	0	0	0	0	0	0	0	T	5.0	7.0
1923	5.0	7.4	17.0	3.5	T	0	0	0	0	1.0	0	T	33.9
1924	14.0	10.0	5.0	T	0	0	0	0	0	0	0.5	3.5	33.0
1925	5.0	1.5	1.5	0	T	0	0	0	0	3.0	5.0	6.8	22.8
1926	7.5	9.0	19.3	5.0	0	0	0	0	0	T	4.0	3.5	48.3
1927	9.0	5.0	1.5	2.5	0	0	0	0	0	0	T	1.0	19.0
1928	0.8	2.5	4.0	4.5	0	0	0	0	0	0	0.5	1.0	13.3
1929	10.7	5.0	0.8	0.5	0	0	0	0	0	4.0	1.0	1.7	23.7
1930	16.5	3.0	2.0	0	0	0	0	0	0	0	1.5	3.3	26.3
1931	6.4	2.8	13.0	0	0	0	0	0	0	0	0	12.0	34.2
1932	2.0	1.3	13.9	T	0	0	0	0	0	T	0.5	2.8	20.5
1933	0.2	9.5	10.1	0.7	0	0	0	0	0	T	0.7	4.0	25.2
1934	T	2.0	1.0	0	0	0	0	0	0	0	0	9.2	12.2
1935	9.0	9.2	9.0	T	2.0	0	0	0	0	0	3.0	5.0	37.2
1936	16.0	23.0	3.0	10.0	0	0	0	0	0	0	1.0	4.0	57.0
1937	2.0	4.2	4.2	1.0	0	0	0	0	0	0	1.2	4.0	16.6
1938	3.5	1.5	4.0	4.0	0	0	0	0	0	0	0.5	2.0	15.5
1939	6.0	6.3	9.0	T	0	0	0	0	0	0	T	0.2	21.5
1940	11.5	15.2	4.8	....	0.5	0	0	0	0	0	6.5	3.0	41.5
1941	9.0	4.5	6.0	0	0	0	0	0	0	0	T	6.0	25.5
1942	7.5	4.0	T	0	0	0	0	0	0	0	2.5	7.5	21.5
1943	19.0	....	6.5	T	0	0	0	0	T	T	0.5	T	26.0
1944	1.5	7.0	6.5	T	0	0	0	0	0	0	1.8	9.0	25.8
1945	6.7	6.2	0	T	T	0	0	0	0	0	2.8	7.9	23.6
1946	0.2	8.0	7.0	0	0	0	0	0	0	0	T	10.2	25.4
1947	18.5	1.2	2.8	2.0	0	0	0	0	0	0	13.5	2.7	39.7
Ave.	7.8	6.2	5.1	1.3	T	0	0	0	0	0.3	1.4	5.8	27.9

CHICAGO

1895	15.4	14.0	5.2	....	T	0	0	0	0	0	14.5	3.4	42.5
1896	2.0	27.8	8.9	T	0	0	0	0	0	3.0	4.2	1.3	47.2
1897	13.1	14.6	11.2	0.9	0	0	0	0	0	0	T	6.2	46.0

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1898	15.9	13.7	1.0	T	0	0	0	0	0	T	1.8	2.7	35.1
1899	2.6	3.5	7.2	T	0	0	0	0	0	0	T	3.5	16.8
1900	0.3	22.6	6.8	3.6	0	0	0	0	0	0	1.1	3.6	39.0
1901	9.2	21.1	5.9	T	0	0	0	0	0	0	0.1	4.5	40.8
1902	6.2	5.5	2.1	0.1	0	0	0	0	0	0	0.5	5.3	19.7
1903	5.0	19.5	0.7	3.2	0	0	0	0	0	0	2.2	18.6	49.2
1904	11.0	13.4	14.3	T	0	0	0	0	0	T	T	6.7	45.4
1905	8.5	13.7	4.5	0.2	T	0	0	0	0	T	T	2.8	37.7
1906	2.9	5.0	9.0	0	0	0	0	0	0	T	2.8	0.3	20.0
1907	10.9	10.0	2.1	1.9	1.3	0	0	0	0	0	3.0	12.8	40.0
1908	13.2	19.8	0.1	T	0	0	0	0	0	0	0.9	2.7	36.7
1909	8.7	10.1	3.8	0.3	T	0	0	0	0	0	T	19.1	42.0
1910	14.8	2.8	T	6.9	0	T	0	0	0	T	1.3	9.2	35.0
1911	2.2	10.4	4.9	2.4	0.1	0	0	0	0	T	1.2	7.8	29.0
1912	7.1	9.9	15.5	0.1	0	0	0	0	0	0	0.4	T	33.0
1913	7.8	5.5	7.0	T	0	0	0	0	0	1.9	T	2.7	22.9
1914	14.8	7.2	1.2	0.1	0	0	0	0	0	T	T	8.4	31.7
1915	6.5	0.5	3.6	T	0	0	0	0	0	0	0.7	9.2	20.5
1916	2.7	8.0	5.5	0	0	0	0	0	0	T	0.1	7.1	23.4
1917	9.9	4.5	2.1	T	T	0	0	0	0	1.3	1.5	9.0	28.3
1918	42.5	8.4	1.4	T	0	0	0	0	0	T	0.5	8.8	61.6
1919	1.8	6.6	11.0	T	0	0	0	0	0	0	0.6	8.2	28.4
1920	12.0	1.7	3.3	6.4	0	0	0	0	0	0.2	1.3	4.4	29.3
1921	3.2	0.2	T	0.4	0	0	0	0	0	T	1.6	4.2	9.7
1922	2.0	0.9	2.8	T	0	0	0	0	0	0	0.2	2.4	8.3
1923	4.4	8.0	5.3	0.6	0.6	0	0	0	0	0.7	T	1.6	21.2
1924	5.7	7.7	11.9	T	T	0	0	0	0	0	1.0	3.3	29.6
1925	6.8	4.7	3.1	0	T	0	0	0	0	1.2	2.3	6.2	24.3
1926	3.9	9.0	23.1	6.6	0	0	0	0	0	T	3.9	5.5	52.0
1927	12.2	1.3	0.4	0.5	0	0	0	0	0	0	4.9	10.0	29.3
1928	0.2	8.5	8.3	1.0	0	0	0	0	T	0	T	3.6	21.6
1929	17.2	8.6	0.7	T	T	0	0	0	0	0.7	0.1	20.2	47.5
1930	13.9	1.5	21.6	T	0	0	0	0	0	T	1.7	3.2	42.1
1931	2.1	0.4	19.8	T	0	0	0	0	0	0	0.2	5.6	28.1
1932	1.9	5.7	11.3	T	0	0	0	0	0	T	0.6	7.3	26.7
1933	0.9	12.7	6.5	0.1	0	0	0	0	0	T	1.4	7.1	28.7
1934	0.3	9.3	7.3	T	0	0	0	0	0	T	T	27.4	44.3
1935	6.0	6.7	4.5	0.6	T	0	0	0	0	T	0.5	8.2	26.5
1936	11.6	12.7	2.0	4.8	0	0	0	0	0	T	0.6	0.8	32.5
1937	2.4	3.1	4.8	0.3	0	0	0	0	0	T	2.7	3.4	16.7
1938	6.3	5.4	2.8	13.6	0	0	0	0	0	T	0.2	3.5	31.8

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1939	24.7	5.1	0.3	0.1	0	0	0	0	0	0	0.4	0.5	31.1
1940	8.6	12.9	6.3	0.1	2.2	0	0	0	0	0	14.8	4.1	49.0
1941	10.7	11.2	11.7	0	0	0	0	0	0	0	5.2	1.7	40.5
1942	4.6	9.2	9.1	T	0	0	0	0	T	T	5.0	8.6	36.5
1943	20.5	0.6	9.5	0.5	0	0	0	0	0	0	T	T	31.1
1944	4.0	11.5	7.2	T	0	0	0	0	0	0	0.8	12.9	36.4
1945	11.2	4.3	1.0	T	0	0	0	0	0	0	0.2	10.0	25.5
1946	2.8	7.3	0.5	0	0	0	0	0	0	0	0	7.0	17.6
1947	10.2	2.2	10.3	T	T	0	0	0	0	0	6.2	6.1	35.0
Ave.	8.4	8.5	6.2	1.0	1.0	0	0	0	T	0.2	1.7	6.4	32.7

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1901	0.3	6.6	1.1	0.2	0	0	0	0	0	0	0.1	3.1	11.4
1902	5.5	0.4	1.0	0	0	0	0	0	0	0	0.9	6.1	13.9
1903	8.0	6.1	0.2	6.1	0	0	0	0	0	0	0.2	2.2	22.8
1904	8.8	3.1	4.7	T	0	0	0	0	0	0	C	3.7	20.3
1905	4.6	13.3	T	1.0	0	0	0	0	0	T	T	0.6	19.5
1906	6.6	3.5	10.5	0	0	0	0	0	0	0	4.5	0.1	25.2
1907	6.9	1.3	3.0	T	T	0	0	0	0	0	T	3.6	14.8
1908	5.0	13.5	0	T	0	0	0	0	0	0	T	4.0	22.5
1909	4.6	6.0	0.3	T	T	0	0	0	0	T	T	8.3	19.2
1910	1.2	1.3	0	T	0	0	0	0	0	T	0	0.1	2.6
1911	3.5	4.6	0.1	0	0	0	0	0	0	T	2.0	3.0	13.2
1912	3.4	8.4	10.5	T	0	0	0	0	0	T	T	T	22.3
1913	4.5	11.7	1.6	T	0	0	0	0	0	T	0	5.0	22.8
1914	1.8	12.3	T	T	0	0	0	0	0	0	T	13.0	27.1
1915	6.2	1.0	7.0	0	0	0	0	0	0	0	T	3.0	17.2
1916	3.0	5.0	1.6	T	0	0	0	0	0	2.0	T	2.6	14.2
1917	0.1	1.0	T	2.5	T	0	0	0	0	T	T	6.0	9.6
1918	8.0	0.5	T	T	0	0	0	0	0	0	0.6	14.5	23.6
1919	0.1	5.1	0.2	T	0	0	0	0	0	0	1.6	0.5	7.5
1920	3.8	0.3	3.3	8.6	0	0	0	0	0	T	T	2.1	18.1
1921	7.6	3.2	T	0.9	0	0	0	0	0	0	1.5	3.5	16.7
1922	3.5	2.1	2.9	0	0	0	0	0	0	0	0	1.3	9.8
1923	7.3	0.8	6.3	T	T	0	0	0	0	T	3.7	1.1	19.2
1924	9.0	12.0	7.1	T	0	0	0	0	0	0	T	7.8	35.9
1925	5.6	5.6	1.7	0	0	0	0	0	0	6.6	4.7	10.8	35.0
1926	5.8	3.2	17.9	9.2	0	0	0	0	0	0	6.3	5.7	48.1

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1927	12.6	1.2	0.9	T	0	0	0	0	0	0	T	6.7	19.4
1928	0.8	1.7	3.1	2.3	0	0	0	0	0	0	0.3	2.3	10.5
1929	9.4	5.8	T	0	0	0	0	0	0	0.4	0.4	7.7	23.7
1930	16.4	1.0	0.2	0	0	0	0	0	0	T	0.1	0.7	18.4
1931	1.2	0.1	15.9	T	0	0	0	0	0	0	1.0	3.5	21.7
1932	1.7	2.1	4.8	0	0	0	0	0	0	T	3.3	6.6	18.5
1933	0.6	5.8	3.1	T	0	0	0	0	0	0	T	0.4	9.9
1934	0.4	8.1	9.5	0	0	0	0	0	0	0	T	6.5	24.5
1935	2.3	1.0	1.6	2.5	0	0	0	0	0	0	T	6.8	14.2
1936	14.6	5.5	T	2.9	0	0	0	0	0	0	0.5	1.3	24.8
1937	3.3	3.6	0.8	T	0	0	0	0	0	T	5.5	0.9	14.1
1938	2.1	10.7	T	12.8	0	0	0	0	0	0	0.7	2.6	28.9
1939	3.8	0.9	T	T	0	0	0	0	0	T	T	5.9	10.6
1940	5.4	2.5	3.7	0.9	0	0	0	0	0	0	3.8	0.1	16.4
1941	10.1	0.5	1.5	0	0	0	0	0	0	0	1.1	1.4	14.6
1942	1.6	4.7	T	T	0	0	0	0	T	T	2.2	11.5	20.0
1943	8.5	4.9	3.8	T	0	0	0	0	0	0	0.5	5.7	23.4
1944	0	6.3	3.7	0	T	0	0	0	0	0	0.6	7.9	18.5
1945	9.9	1.7	3.2	T	0	0	0	0	0	0	0.5	6.8	22.1
1946	1.5	3.1	2.0	0.6	0	0	0	0	0	0	0	1.0	8.2
1947	3.5	0.5	5.3	T	0	0	0	0	0	0	1.0	3.5	13.8
Ave.	5.0	4.3	3.0	1.1	T	0	0	0	0	T	1.0	4.2	18.6

PEORIA

1885	18.0	10.0	0.2	0.1	0	0	0	0	0	0	0	8.0	26.3
1886	17.0	1.0	5.2	0.4	0	0	0	0	0	0	1.5	7.7	32.8
1887	4.2	1.7	7.0	0.5	0	0	0	0	0	T	0.4	8.2	22.0
1888	6.6	1.3	0.5	0	0	0	0	0	0	0	0.3	0.3	9.0
1889	3.6	8.0	1.2	0	0	0	0	0	0	0	3.0	0	15.8
1890	1.0	6.0	3.0	0	0	0	0	0	0	0	0	0	10.0
1891	4.8	1.0	7.0	0.6	0	0	0	0	0	0	0.6	2.5	16.5
1892	8.5	1.7	1.3	0	0	0	0	0	0	0	4.6	0.3	16.4
1893	8.9	16.5	0.4	0	0	0	0	0	0	0	4.0	10.0	39.8
1894	5.0	8.0	0.3	0	0	0	0	0	0	0	0.7	T	14.0
1895	7.0	2.5	4.0	2.0	0	0	0	0	0	0	5.0	6.9	27.4
1896	1.3	12.0	1.5	3.0	0	0	0	0	0	0	3.0	T	20.8
1897	9.0	5.2	4.7	0.5	0	0	0	0	0	0	0.5	5.5	25.4
1898	9.5	5.0	2.0	T	0	0	0	0	0	0	2.1	1.0	19.6
1899	2.0	1.7	8.5	0	0	0	0	0	0	0	T	5.0	17.2
1900	T	26.5	1.4	0.8	0	0	0	0	0	0	0.5	0.6	29.8

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1901	1.0	10.8	0.5	0	0	0	0	0	0	0	0	3.7	16.0
1902	6.3	2.1	0.2	0	0	0	0	0	0	0	T	0.6	9.2
1903	7.0	4.5	0	0	0	0	0	0	0	0	0	4.0	15.5
1904	9.9	10.0	5.3	0	0	0	0	0	0	0	0	3.2	28.4
1905	10.5	12.8	0.3	0.5	0	0	0	0	0	T	T	1.5	25.6
1906	3.1	0.1	13.2	0	0	0	0	0	0	T	0.3	0.6	17.3
1907	8.5	1.4	7.9	0.7	0	0	0	0	0	0	T	2.5	21.0
1908	3.4	12.3	T	T	0	0	0	0	0	0	0.2	3.8	19.7
1909	2.7	5.0	1.4	T	0	0	0	0	0	T	T	18.0	27.1
1910	2.3	2.1	0.0	1.7	0	0	0	0	0	T	T	1.6	7.7
1911	11.3	7.2	0.1	4.0	0	0	0	0	0	T	2.7	6.3	31.6
1912	2.1	8.5	10.5	4.5	0	0	0	0	0	0	T	T	25.6
1913	7.3	9.5	5.3	T	0	0	0	0	0	0.1	T	3.0	25.2
1914	8.6	12.2	1.1	T	0	0	0	0	0	0	T	14.4	36.3
1915	8.4	0.1	4.1	0	0	0	0	0	0	0	T	7.2	19.8
1916	3.9	3.1	4.0	0	0	0	0	0	0	0.3	T	3.9	15.2
1917	4.1	1.2	T	T	0	0	0	0	0	0.6	T	7.4	13.3
1918	16.9	0.4	0.2	T	0	0	0	0	0	0	T	7.0	24.5
1919	0.3	9.8	4.4	0	0	0	0	0	0	0	0.9	1.2	16.6
1920	8.5	0.2	0.3	8.2	0	0	0	0	0	T	0.5	4.6	22.3
1921	3.2	0.2	T	0.1	0	0	0	0	0	0	4.2	1.2	8.9
1922	2.8	0.6	1.3	0	0	0	0	0	0	0	2.5	1.9	9.1
1923	5.4	1.5	3.7	1.6	0.1	0	0	0	0	T	T	0.6	12.9
1924	5.0	5.0	7.9	0.4	0	0	0	0	0	0	0.2	6.6	26.0
1925	5.1	1.1	7.3	0	0	0	0	0	0	2.8	4.8	3.0	24.1
1926	4.8	3.0	18.2	7.4	0	0	0	0	0	0	10.7	1.6	44.7
1927	15.5	1.3	0.3	0.1	0	0	0	0	0	0	T	6.5	23.7
1928	1.0	1.1	2.5	0.1	0	0	0	0	0	0	T	1.3	6.0
1929	10.1	4.1	T	T	0	0	0	0	0	3.3	0.8	9.5	27.2
1930	14.1	0.6	5.6	0	0	0	0	0	0	T	3.8	1.2	25.3
1931	1.2	T	10.3	T	0	0	0	0	0	0	0.7	4.9	17.1
1932	1.6	3.4	5.9	T	0	0	0	0	0	T	5.6	5.9	22.4
1933	0.6	10.9	4.1	T	0	0	0	0	0	0	T	1.5	17.1
1934	0.8	10.8	14.7	T	0	0	0	0	0	0	0	8.2	34.5
1935	0.1	1.2	0.1	3.0	0	0	0	0	0	0	0.1	10.9	15.4
1936	15.4	7.5	0.9	3.0	0	0	0	0	0	T	0.1	0.6	27.5
1937	4.7	2.0	1.2	T	0	0	0	0	0	T	4.1	0.8	12.8
1938	6.3	7.0	T	6.2	0	0	0	0	0	T	0.6	0.9	21.0
1939	15.8	2.9	T	T	0	0	0	0	0	0	T	8.0	26.7
1940	4.3	8.2	2.3	T	0	0	0	0	0	0	1.2	0.3	16.3

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1941	9.1	3.2	5.1	0	0	0	0	0	0	0	3.5	3.6	24.5
1942	3.5	8.9	0.7	0	0	0	0	0	1.0	0	3.2	9.4	26.8
1943	14.3	6.5	7.7	0.2	0	0	0	0	0	0	0.4	3.0	32.1
1944	T	7.5	2.4	0	T	0	0	0	0	0	0.3	8.3	22.4
1945	7.1	3.0	2.7	T	0	0	0	0	0	0	0.5	7.0	20.2
1946	1.8	3.2	9.9	T	0	0	0	0	0	0	0	5.1	20.0
1947	5.1	5.3	6.8	T	0	0	0	0	0	0	3.6	1.8	22.6
Ave.	6.2	5.3	3.6	0.8	T	0	0	0	T	0.1	1.3	4.1	21.5

SPRINGFIELD

1893	4.4	6.0	1.2	T	0	0	0	0	0	0	0.3	3.9	15.8
1894	8.6	12.1	0.6	T	0	0	0	0	0	0	T	T	21.3
1895	6.3	2.8	2.9	0.7	0	0	0	0	0	0	5.1	1.5	19.3
1896	0.5	4.6	4.6	0	0	0	0	0	0	T	3.7	T	13.4
1897	6.9	5.0	0.4	0.1	0	0	0	0	0	0	T	1.9	14.3
1898	4.7	1.7	1.2	T	0	0	0	0	0	T	0.6	1.1	9.3
1899	3.6	2.4	5.8	3.8	0	0	0	0	0	0	3.6	4.7	26.9
1900	0.1	24.4	1.5	1.3	0	0	0	0	0	0	1.2	2.6	31.1
1901	1.8	4.6	0.8	T	0	0	0	0	0	0	0	5.5	12.7
1902	11.7	3.5	0.3	0	0	0	0	0	0	0	T	2.7	18.2
1903	11.9	15.3	0.3	1.0	0	0	0	0	0	0	0.6	4.4	32.9
1904	11.9	4.6	2.1	0.1	0	0	0	0	0	0	0	4.6	23.3
1905	5.0	7.4	T	0.4	0	0	0	0	0	0	T	4.0	16.8
1906	3.4	5.5	23.4	0	0	0	0	0	0	0	0.1	1.0	33.4
1907	2.8	3.2	4.1	T	0	0	0	0	0	0	T	7.0	17.1
1908	7.5	17.2	0	T	0	0	0	0	0	0	T	3.0	27.7
1909	6.4	7.6	0.2	T	T	0	0	0	0	T	0	13.3	27.5
1910	2.4	5.4	0	3.6	0	0	0	0	0	T	T	0.2	11.6
1911	1.9	6.0	T	T	0	0	0	0	0	0	2.6	5.0	15.5
1912	4.8	9.9	11.0	T	0	0	0	0	0	0	T	T	25.7
1913	0.8	8.0	6.8	T	0	0	0	0	0	0.9	T	3.0	19.5
1914	14.5	18.4	6.2	T	0	0	0	0	0	0	T	8.6	47.7
1915	11.2	3.5	3.7	0	0	0	0	0	0	0	1.5	13.4	33.3
1916	1.5	7.4	7.7	0.6	0	0	0	0	0	1.8	T	1.7	20.7
1917	0.6	1.3	0.3	0.5	T	0	0	0	0	0.2	0.8	8.8	12.5
1918	19.2	0.6	T	0	0	0	0	0	T	0	T	2.6	22.4
1919	0.9	5.1	4.5	T	0	0	0	0	0	0	0.1	0.8	11.4
1920	4.8	0.3	0.3	8.2	0	0	0	0	0	T	0.4	7.5	21.5

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1921	3.6	0.7	0.2	0.8	0	0	0	0	0	0	0.1	1.8	7.2
1922	7.1	0.4	6.3	0	0	0	0	0	0	0	1.0	1.2	16.0
1923	3.8	1.6	1.3	T	T	0	0	0	0	T	0	0.8	7.5
1924	6.6	7.3	8.7	0.2	0	0	0	0	0	0	T	1.5	24.3
1925	2.9	4.0	1.5	0	0	0	0	0	0	2.8	1.3	2.2	14.7
1926	2.5	1.0	13.1	0.4	0	0	0	0	0	0	8.4	1.7	27.1
1927	8.5	0.3	0.4	T	0	0	0	0	0	0	3.3	6.9	19.7
1928	1.9	2.8	0.7	T	0.6	0	0	0	0	0	T	0.2	5.6
1929	4.3	3.6	T	0	0	0	0	0	0	2.4	0.3	10.5	21.7
1930	6.1	1.8	5.1	0	0	0	0	0	0	0.3	0.4	0.6	14.3
1931	0.4	0.1	15.1	T	0	0	0	0	0	0	2.8	1.0	19.4
1932	0.2	1.2	3.4	0	0	0	0	0	0	0	7.6	4.2	16.6
1933	T	2.2	4.6	T	0	0	0	0	0	0	T	0.5	7.3
1934	0.2	10.2	15.7	0	0	0	0	0	0	0	0	9.4	35.5
1935	0.2	T	1.3	1.6	0	0	0	0	0	0	T	4.8	7.9
1936	13.0	1.6	1.2	0.3	0	0	0	0	0	T	0.8	1.1	18.0
1937	4.7	4.5	3.9	T	0	0	0	0	0	T	2.6	T	15.7
1938	1.7	2.4	0	0.1	0	0	0	0	0	0	0.3	0.5	5.0
1939	16.3	2.9	T	0.1	0	0	0	0	0	0	T	6.9	26.2
1940	8.2	1.6	0.1	1.4	0.2	0	0	0	0	0	T	1.5	13.0
1941	8.4	4.5	4.7	0	0	0	0	0	0	0	4.8	1.7	23.1
1942	2.4	9.4	1.2	T	0	0	0	0	T	T	4.0	8.1	25.1
1943	3.1	0.6	4.0	T	0	0	0	0	0	T	T	11.7	19.4
1944	T	8.9	6.3	T	0	0	0	0	0	T	0.5	14.5	30.2
1945	9.7	3.7	2.0	T	T	0	0	0	0	0	0.3	10.7	26.4
1946	1.2	4.8	0.2	1.0	0	0	0	0	0	0	0	0.7	7.9
1947	5.0	4.5	10.7	0	0	0	0	0	0	0	0.3	0.8	21.3
Ave.	5.5	5.1	3.7	0.5	T	0	0	0	T	0.2	1.1	3.8	19.9

URBANA

1904	18.2	4.0	4.0	0	0	0	0	0	0	0	0	7.5	33.7
1905	6.5	18.5	0	0.4	0	0	0	0	0	0	0	1.0	26.4
1906	1.0	2.0	32.0	0	0	0	0	0	0	0	T	1.0	36.0
1907	5.5	2.5	7.0	T	0	0	0	0	0	0	0.6	6.5	22.1
1908	2.7	11.5	0	0	0	0	0	0	0	0	T	6.5	20.7
1909	8.0	10.0	T	T	T	0	0	0	0	T	0	18.0	36.0
1910	2.0	8.3	0	4.5	0	0	0	0	0	T	T	1.0	15.8

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1911	5.0	4.5	T	T	0	0	0	0	0	0	2.5	1.5	13.5
1912	5.0	16.5	12.3	T	0	0	0	0	0	0	T	T	31.8
1913	3.0	8.0	8.0	T	0	0	0	0	0	0.5	T	2.0	21.5
1914	7.4	18.5	2.0	T	0	0	0	0	0	T	T	13.2	41.1
1915	11.7	0.5	3.5	T	0	0	0	0	0	0	1.1	13.3	30.1
1916	1.2	6.4	5.7	T	0	0	0	0	0	1.4	0.3	4.3	19.3
1917	2.5	1.4	T	T	T	0	0	0	0	0.9	0.2	10.3	15.3
1918	12.8	0.5	T	T	0	0	0	0	0	T	T	0.6	13.9
1919	0.4	6.2	4.0	T	0	0	0	0	0	0	0	0.2	10.8
1920	8.1	0.5	3.0	8.0	0	0	0	0	0	T	0.2	6.9	26.7
1921	2.6	T	0	4.0	0	0	0	0	0	0	0.7	1.1	8.4
1922	6.2	0.9	3.4	0	0	0	0	0	0	0	1.3	2.0	13.8
1923	6.6	4.0	T	1.8	T	0	0	0	0	0	T	0.5	12.9
1924	8.1	2.9	11.1	T	0	0	0	0	0	0	T	3.8	25.9
1925	8.3	1.0	1.8	0	0	0	0	0	0	2.5	4.2	1.5	19.3
1926	3.9	4.0	7.8	T	0	0	0	0	0	0	1.5	5.1	22.3
1927	13.7	1.0	T	T	0	0	0	0	0	0	2.8	2.5	20.0
1928	1.5	2.6	0.9	T	0	0	0	0	0	0	0.3	0.5	5.6
1929	5.3	3.7	0.5	T	2.5	0	0	0	0	1.5	0.8	11.2	25.5
1930	5.1	0.8	6.2	0	0	0	0	0	0	0	2.0	0.3	14.4
1931	3.3	0.3	10.7	T	T	0	0	0	0	0	3.7	0.3	18.3
1932	2.3	0.6	3.4	0	0	0	0	0	0	T	11.2	3.4	20.9
1933	0.3	6.2	4.7	T	0	0	0	0	0	0	0.1	0.2	11.5
1934	0.6	7.4	14.2	T	0	0	0	0	0	0	0	10.2	32.4
1935	0.2	0.3	0.3	T	0	0	0	0	0	0	0.1	5.1	6.0
1936	5.7	3.4	2.5	0.7	0	0	0	0	0	T	T	3.6	15.9
1937	5.1	3.9	4.7	T	0	0	0	0	0	T	4.9	0.6	19.2
1938	3.0	2.0	T	T	T	0	0	0	0	0	1.6	0.6	7.2
1939	11.2	5.9	T	0.3	0	0	0	0	0	0	1.2	4.4	23.0
1940	6.2	5.0	0.7	5.2	T	0	0	0	0	0	0.2	1.7	19.0
1941	5.2	4.2	3.8	0	0	0	0	0	0	0	5.5	1.8	20.5
1942	1.8	5.9	5.5	T	0	0	0	0	T	0	5.0	8.6	26.8
1943	3.3	1.7	2.8	1.0	0	0	0	0	0	0	1.1	6.4	16.3
1944	T	14.9	3.6	T	0	0	0	0	0	0	0.7	11.3	30.5
1945	3.6	2.5	1.0	0	0	0	0	0	0	0	0.5	10.1	17.7
1946	6.5	2.2	3.0	2.0	0	0	0	0	0	0	0	1.1	14.8
1947	3.9	1.5	6.8	0	0	0	0	0	0	0	0.6	2.4	15.2
Ave.	5.1	4.7	4.1	0.6	T	0	0	0	0	0.1	1.3	4.4	20.3

ST. LOUIS

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1885	10.5	4.2	0.3	0	0	0	0	0	0	0	0	9.6	15.6
1886	9.6	T	1.0	6.5	0	0	0	0	0	0	0	3.9	22.0
1887	3.5	T	3.5	0.8	0	0	0	0	0	0	4.0	7.4	19.2
1888	4.3	3.3	0	0	0	0	0	0	0	0	0.1	0.7	8.4
1889	1.5	10.0	T	0	0	0	0	0	0	0	1.2	T	12.7
1890	4.0	7.5	21.0	0	0	0	0	0	0	0	T	0	32.5
1891	3.2	1.1	3.3	T	0	0	0	0	0	0	0	11.0	18.6
1892	14.0	T	2.0	0	0	0	0	0	0	0	0	0	16.0
1893	2.3	8.7	2.6	T	0	0	0	0	0	0	T	0.6	14.2
1894	2.2	5.6	0.3	0	0	0	0	0	0	0	T	T	8.1
1895	8.1	3.7	9.3	T	0	0	0	0	0	0	4.0	3.5	28.6
1896	T	3.1	6.6	0	0	0	0	0	0	0	0.7	T	10.4
1897	5.2	7.1	T	T	0	0	0	0	0	0	T	4.3	16.6
1898	0.9	0.8	3.8	T	0	0	0	0	0	0.2	0.5	3.5	9.7
1899	2.9	6.4	10.3	4.5	0	0	0	0	0	0	3.7	10.1	33.8
1900	T	9.3	0.5	T	0	0	0	0	0	0	0	1.7	11.5
1901	0.2	8.6	2.1	4.5	0	0	0	0	0	0	T	6.9	22.3
1902	6.6	1.7	T	0	0	0	0	0	0	0	0.3	1.7	10.3
1903	8.4	7.6	0.3	T	0	0	0	0	0	0	1.5	2.7	19.2
1904	14.3	2.5	T	5.5	0	0	0	0	0	0	0	5.4	27.7
1905	6.8	7.5	0	0	0	0	0	0	0	T	T	T	14.3
1906	5.0	15.9	17.5	T	0	0	0	0	0	0	2.0	1.6	42.0
1907	2.2	7.9	T	T	0	0	0	0	0	0	0.1	6.5	16.7
1908	6.0	4.4	2.7	0	0	0	0	0	0	0	T	0.1	13.2
1909	14.2	4.7	0.1	0	T	0	0	0	0	T	0	9.1	28.1
1910	1.0	21.3	0	2.3	0	0	0	0	0	T	0	2.2	26.8
1911	0.5	13.0	3.5	0	0	0	0	0	0	T	1.8	2.6	21.4
1912	13.2	21.2	28.8	T	0	0	0	0	0	0	T	0.1	63.3
1913	T	7.0	8.6	0	0	0	0	0	0	0.3	0	11.2	27.1
1914	3.0	23.5	5.2	T	0	0	0	0	0	0	T	2.4	34.1
1915	11.6	1.6	2.0	T	0	0	0	0	0	0	T	13.0	28.2
1916	2.7	5.7	9.4	0.5	0	0	0	0	0	0.1	0.1	2.5	20.8
1917	2.5	1.0	0.3	1.0	0	0	0	0	0	0.2	0.1	7.5	12.6
1918	11.7	0.2	0	T	0	0	0	0	0	0	T	0.5	12.4
1919	0.7	3.1	1.2	T	0	0	0	0	0	0	T	0.3	5.3
1920	9.3	1.0	1.9	0.2	0	0	0	0	0	T	T	3.4	15.8
1921	2.2	T	0	T	0	0	0	0	0	0	T	2.4	4.6
1922	4.1	0.8	5.2	0	0	?	0	0	0	0	T	0.5	10.6
1923	0	5.1	0.1	T	T	0	0	0	0	0	T	0.7	5.9
1924	3.9	2.3	15.8	T	0	0	0	0	0	0	1.1	2.1	25.2
1925	4.9	3.4	T	0	0	0	0	0	0	0.1	0.1	0.2	8.7

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1926	3.1	T	2.1	T	0	0	0	0	0	0	10.4	2.0	17.6
1927	1.7	2.1	3.0	T	0	0	0	0	0	0	0.8	2.5	10.1
1928	1.1	5.1	0.2	T	0	0	0	0	0	0	T	0.7	7.1
1929	2.6	5.7	T	0	4.0	0	0	0	0	T	6.5	6.7	25.5
1930	11.0	4.2	1.5	0	0	0	0	0	0	T	0.2	0.5	17.4
1931	1.5	T	2.7	T	0	0	0	0	0	0	0.3	0	4.5
1932	0.1	T	0.3	0	0	0	0	0	0	0	5.3	3.9	9.6
1933	T	1.5	0.1	T	0	0	0	0	0	0	0	2.2	3.8
1934	1.4	8.5	4.5	0	0	0	0	0	0	0	T	8.8	23.2
1935	T	0.1	0	T	0	0	0	0	0	0	T	2.8	2.9
1936	7.0	2.1	T	T	0	0	0	0	0	T	1.1	4.6	14.8
1937	2.1	1.4	7.7	0	0	0	0	0	0	T	2.5	0.4	14.1
1938	1.1	1.6	0	0.3	0	0	0	0	0	0	2.4	0.2	5.6
1939	10.6	8.3	0.6	T	0	0	0	0	0	T	0	10.5	30.0
1940	10.6	0.8	1.4	T	0	0	0	0	0	0	T	T	12.8
1941	3.3	3.5	0.5	0	0	0	0	0	0	0	3.0	2.2	12.5
1942	0.6	9.3	1.8	0	0	0	0	0	0	0	T	10.2	21.9
1943	2.0	1.0	4.5	T	0	0	0	0	0	0	0.3	4.3	12.1
1944	0.5	6.9	2.8	0	0	0	0	0	0	0	0.3	6.5	17.0
1945	1.9	8.4	T	T	0	0	0	0	0	0	T	8.3	18.6
1946	3.5	1.6	0	0	0	0	0	0	0	0	T	T	5.1
1947	1.8	5.8	12.8	0	0	0	0	0	0	0	0.5	0.7	21.6
Ave.	4.9	5.6	3.8	0.6	0.1	0	0	0	0	T	0.8	3.2	19.0

GREENVILLE

1895	8.5	5.4	4.7	0	0	0	0	0	0	0	3.5	12.0	24.1
1896	T	3.0	9.8	0	0	0	0	0	0	0	5.0	0	17.8
1897	13.3	9.6	....	0	0	0	0	0	0	0	0	4.7	27.6
1898	2.0	1.7	2.6	0	0	0	0	0	0	0	0.6	2.1	9.0
1899	....	2.0	10.5	5.2	0	0	0	0	0	0	4.6	9.7	32.0
1900	0	13.0	1.7	0	0	0	0	0	0	0	....	2.5	17.2
1901	1.0	5.1	1.0	0	0	0	0	0	0	0	0	5.0	12.1
1902	6.1	6.2	....	0	0	0	0	0	0	0	T	1.8	10.1
1903	5.0	8.3	1.0	0	0	0	0	0	0	0	3.0	3.4	20.7
1904	20.4	1.0	0.4	4.5	0	0	0	0	0	0	0	5.5	31.8
1905	7.5	11.3	0	0.5	0	0	0	0	0	0	0	0.7	20.0
1906	5.0	15.5	13.5	0	0	0	0	0	0	0	1.5	1.0	36.5
1907	1.5	6.5	0	T	0	0	0	0	0	0	T	8.6	16.6
1908	4.5	14.5	0	0	0	0	0	0	0	0	0.5	0	19.5
1909	16.5	4.5	0	0	0	0	0	0	0	0	0	12.2	33.2

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1910	1.5	20.5	0	1.5	0	0	0	0	0	T	0	T	23.5
1911	0.5	8.5	2.5	0	0	0	0	0	0	T	2.5	....	14.0
1912	5.8	23.5	22.9	....	0	0	0	0	0	0	0	T	52.2
1913	T	5.2	8.7	0	0	0	0	0	0	0.3	T	4.0	18.2
1914	1.0	18.3	2.0	0	0	0	0	0	0	0	0	3.7	25.0
1915	9.5	2.5	3.0	0	0	0	0	0	0	0	T	10.9	25.9
1916	2.0	8.8	5.8	T	0	0	0	0	0	T	T	3.5	20.1
1917	3.0	T	0.3	0.5	0	0	0	0	0	T	0.5	9.0	13.3
1918	15.5	0	0	0	0	0	0	0	0	0	0	T	15.5
1919	1.0	....	....	0	0	0	0	0	0	0	0	0.1	....
1920	6.7	0.5	T	T	0	0	0	0	0	T	T	4.5	11.7
1921	2.3	0.2	0	T	0	0	0	0	0	0	T	1.5	4.0
1922	3.5	0.4	4.0	0	0	0	0	0	0	0	T	0.8	8.7
1923	T	5.3	T	T	T	0	0	0	0	0	0	T	5.3
1924	3.4	2.1	10.1	T	0	0	0	0	0	0	0.6	1.8	18.0
1925	5.2	2.7	0.6	0	0	0	0	0	0	T	T	T	8.5
1926	2.0	T	2.6	T	0	0	0	0	0	0	2.2	5.1	11.9
1927	3.6	0.6	1.9	T	0	0	0	0	0	0	0.4	1.5	8.0
1928	1.3	4.0	T-	T	0	0	0	0	0	0	T	T	5.3
1929	4.2	4.5	T	0	T	0	0	0	0	T	1.0	10.0	19.7
1930	11.5	4.2	6.0	0	0	0	0	0	0	0.1	0.1	0.2	22.1
1931	T	T	0.3	0	0	0	0	0	0	0	0.8	0	1.1
1932	T	1.0	0.6	0	0	0	0	0	0	0	6.1	3.2	10.9
1933	T	0.5	0.3	T	0	0	0	0	0	T	T	2.0	2.8
1934	3.0	7.5	4.8	T	0	0	0	0	0	0	0	8.8	24.1
1935	2.0	T	0	T	0	0	0	0	0	0	T	2.5	4.5
1936	11.7	2.2	0.5	T	0	0	0	0	0	0	1.0	4.5	19.9
1937	6.1	0.4	9.0	T	0	0	0	0	0	T	3.0	T	18.5
1938	0.5	0.3	0	0	0	0	0	0	0	0	3.0	T	3.8
1939	8.6	9.0	T	T	0	0	0	0	0	0	T	9.2	26.8
1940	13.9	0.3	0.1	1.0	0	0	0	0	0	0	T	T	15.3
1941	1.0	6.0	1.0	0	0	0	0	0	0	0	3.0	1.5	12.5
1942	0.8	11.0	T	0	0	0	0	0	0	0	T	8.0	19.8
1943	2.8	1.3	2.9	T	0	0	0	0	0	0	0	8.0	15.0
1944	0	8.0	2.0	0	T	0	0	0	0	0	1.3	9.0	20.3
1945	6.4	....	0	0	0	0	0	0	0	0	0.5	8.7	21.0
1946	4.3	1.0	0	0	0	0	0	0	0	0	0	T	5.3
1947	1.8	1.6	9.7	0	0	0	0	0	0	0	T	2.2	15.3
Ave.	4.5	5.3	3.0	0.2	T	0	0	0	0	T	0.9	3.7	17.6

TERRE HAUTE

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1901	0.8	2.3	2.5	T	0	0	0	0	0	0	0	T	5.6
1902	5.8	4.5	T	T	0	0	0	0	0	0	0.8	3.0	14.1
1903	11.5	10.5	T	T	0	0	0	0	0	0	T	6.2	28.2
1904	23.5	3.5	2.0	0	0	0	0	0	0	0	0	4.5	33.5
1905	6.5	13.0	0	0	0	0	0	0	0	0	0	T	19.5
1906	2.0	12.4	25.5	0	0	0	0	0	0	0	T	1.2	41.1
1907	1.8	0.5	3.0	0	0	0	0	0	0	0	T	2.0	7.3
1908	T	8.0	0	0	0	0	0	0	0	0	0.2	1.2	9.4
1909	14.0	2.8	0	0	0	0	0	0	0	0	0	7.0	23.8
1910	7.5	10.6	0	0.5	0	0	0	0	0	0	0	2.0	20.6
1911	6.7	4.0	0	0	0	0	0	0	0	0	.6	T	11.3
1912	8.0	16.7	8.5	0	0	0	0	0	0	0	0.1	T	33.3
1913	2.1	5.3	6.0	0	0	0	0	0	0	0.8	T	0.1	14.3
1914	7.0	17.5	2.6	T	0	0	0	0	0	0	T	8.5	35.6
1915	12.8	0.1	0.3	0	0	0	0	0	0	0	0.7	7.9	21.8
1916	1.4	7.7	5.5	1.1	0	0	0	0	0	0.2	0.8	7.9	24.6
1917	3.3	1.0	0.8	0.5	0	0	0	0	0	0.6	T	11.0	17.2
1918	20.1	T	T	0.2	0	0	0	0	0	0	T	0.7	21.0
1919	0.7	1.9	1.6	0	0	0	0	0	0	0	0	1.6	5.8
1920	8.5	0.2	0.9	3.6	0	0	0	0	0	T	T	5.7	18.9
1921	4.8	0.1	0	T	0	0	0	0	0	0	0.9	3.7	9.5
1922	8.0	0.1	2.5	0	0	0	0	0	0	0	T	1.6	12.2
1923	0.1	4.1	0.2	1.0	0	0	0	0	0	0	0	T	5.4
1924	4.0	2.9	11.3	0.2	0	0	0	0	0	0	1.5	5.7	25.6
1925	3.1	1.5	4.0	0	0	0	0	0	0.	0.1	0.5	2.7	11.9
1926	6.8	1.1	1.9	T	0	0	0	0	0	T	0.6	7.6	18.0
1927	9.2	4.4	0.3	0	0	0	0	0	0	0	0.9	2.6	17.4
1928	1.8	4.3	0.5	0.2	0	0	0	0	0	0	0.1	2.9	9.8
1929	6.9	5.4	0.2	0	0	0	0	0	0	0.6	0.1	12.9	26.1
1930	12.3	1.5	4.5	0	0	0	0	0	0	0	1.5	1.8	21.6
1931	1.9	0.1	6.2	0	0	0	0	0	0	0	5.5	T	13.7
1932	T	0.1	3.8	T	0	0	0	0	0	0	6.2	3.4	13.5
1933	T	2.1	2.3	T	0	0	0	0	0	0	T	1.2	5.6
1934	1.3	11.7	12.1	T	0	0	0	0	0	0	0	9.2	34.3
1935	0.3	T	T	T	0	0	0	0	0	0	0.2	7.9	8.4
1936	7.8	5.9	4.9	1.0	0	0	0	0	0	0	T	5.6	25.2
1937	4.2	3.5	8.1	T	0	0	0	0	0	T	1.2	0.9	17.9
1938	4.1	2.0	T	3.0	0	0	0	0	0	0	7.4	T	16.5
1939	14.7	7.3	0.2	T	0	0	0	0	0	0	T	5.8	28.0
1940	9.0	7.7	0.6	4.1	0	0	0	0	0	0	T	T	21.4

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1941	3.5	5.4	2.7	0	0	0	0	0	0	0	7.7	4.1	23.4
1942	0.8	3.8	7.8	T	0	0	0	0	0	T	T	9.5	21.9
1943	6.5	0.4	4.1	0.3	0	0	0	0	0	T	0.3	9.9	21.5
1944	T	11.0	1.2	T	0	0	0	0	0	0	0.8	3.7	16.7
1945	4.8	5.0	T	T	0	0	0	0	0	0	1.0	9.9	20.7
1946	5.1	0.6	T	T	0	0	0	0	0	0	0	.8	6.5
1947	0.9	1.5	5.1	0	0	0	0	0	0	0	0.2	5.2	12.9
Ave.	5.8	4.8	3.2	.3	0	0	0	0	0	0.1	0.8	4.0	19.0

MT. VERNON

1896	0.2	0.2	17.0	0	0	0	0	0	0	0	2.5	0	19.9
1897	1.5	4.5	0	0	0	0	0	0	0	0	0	1.0	7.0
1898	1.0	3.0	0	0	0	0	0	0	0	T	2.0	4.0	10.0
1899	4.0	16.8	4.5	T	0	0	0	0	0	0	T	8.5	33.8
1900	1.0	7.8	0.2	....	0	0	0	0	0	0	0	1.5	10.5
1901	0	4.0	T	0	0	0	0	0	0	0	0	8.0	12.0
1902	2.0	1.0	....	0	0	0	0	0	0	0	0.1	2.0	5.1
1903	3.7	2.0	0.4	T	0	0	0	0	0	0	2.0	0.6	8.7
1904	15.0	0.5	T	6.0	0	0	0	0	0	0	0	7.0	28.5
1905	10.0	6.0	0	T	0	0	0	0	0	0	0	....	....
1906	1.0	17.5	1.2	0	0	0	0	0	0	0	2.0	1.0	22.7
1907	2.5	7.0	0	0	0	0	0	0	0	0	T	0.2	9.7
1908	1.5	2.0	0	0	0	0	0	0	0	0	T	0.5	4.0
1909	9.0	4.0	0	0	0	0	0	0	0	0	0	8.0	21.0
1910	1.7	19.0	0	4.0	0	0	0	0	0	0	0	1.8	26.5
1911	0.5	4.0	1.0	0	0	0	0	0	0	0	1.0	0	6.5
1912	13.0	17.5	14.5	0	0	0	0	0	0	0	0	0	45.0
1913	1.0	6.2	5.0	0	0	0	0	0	0	0.5	0	2.5	15.2
1914	3.0	12.5	3.7	T	0	0	0	0	0	0	0	6.0	25.2
1915	9.5	0.5	1.5	0	0	0	0	0	0	0	T	5.0	16.5
1916	3.0	1.5	6.5	0	0	0	0	0	0	T	T	5.2	16.2
1917	2.0	0.4	T	0.2	0	0	0	0	0	0	T	13.3	15.9
1918	12.1	0	0	0	0	0	0	0	0	0-	0	0.5	12.6
1919	1.1	....	T	0	0	0	0	0	0	0	0	T	....
1920	6.7	1.2	1.0	0.3	0	0	0	0	0	0	T	3.0	12.2
1921	2.0	2.0	T	0	0	0	0	0	0	0	T	4.0	8.0
1922	1.5	T	4.0	0	0	0	0	0	0	0	T	0.5	6.0
1923	T-	3.0	0.1	0	T	0	0	0	0	0	0	T	3.1
1924	1.5	4.5	11.0	T	0	0	0	0	0	0	1.0	5.0	23.0
1925	4.5	2.0	0.5	0	0	0	0	0	0	3.0	T	0.5	10.5

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1926	3.2	T	2.0	0	0	0	0	0	0	0	3.5	7.0	15.7
1927	0.2	1.5	4.0	0	0	0	0	0	0	0	T	1.0	6.7
1928	2.0	4.5	1.5	0	0	0	0	0	0	0	0	T	8.0
1929	0.9	....	0	0	T	0	0	0	0	T	5.0	12.0	....
1930	4.0	2.1	....	0	0	0	0	0	0	T	1.2	2.2	....
1931	0.5	0	T	0	0	0	0	0	0	0	T	0	0.5
1932	T	0	0.3	0	0	0	0	0	0	0	4.2	3.7	8.2
1933	0	1.2	T	0	0	0	0	0	0	0	0	3.5	4.7
1934	T	6.5	5.2	0	0	0	0	0	0	0	0	1.6	13.3
1935	T	0	0	0	0	0	0	0	0	0	0	5.0	5.0
1936	5.4	5.0	T	T	0	0	0	0	0	0	0.3	4.0	14.7
1937	4.0	1.0	7.0	0	0	0	0	0	0	0	T	0	12.0
1938	T	0	0	1.2	0	0	0	0	0	0	2.5	0	3.7
1939	7.6	7.5	0	0	0	0	0	0	0	0	0	11.3	26.4
1940	14.9	6.5	0.5	T	0	0	0	0	0	0	0	0	21.9
1941	0	6.0	0	0	0	0	0	0	0	0	T	1.0	7.0
1942	2.0	6.5	4.0	0	0	0	0	0	0	0	0	6.0	18.5
1943	3.5	4.5	0	0	0	0	0	0	0	0	T	1.5	9.5
1944	0	3.0	1.5	0	T	0	0	0	0	0	1.0	4.0	9.5
1945	8.0	6.0	0	0	0	0	0	0	0	0	0	9.0	23.0
1946	2.5	0.5	0	0	0	0	0	0	0	0	0	0	3.0
1947	0.5	2.0	10.5	0	0	0	0	0	0	0	T	3.0	16.0
Ave.	3.3	4.3	2.3	0.2	T	0	0	0	0	0.1	0.5	3.3	14.0

NEW BURNSIDE

1895	....	....	T	0	0	0	0	0	0	0	T	14.5	....
1896	T	T	....	....	....	0	0	0	0	0	0	0	....
1897	2.0	1.5	T	0	0	0	0	0	0	0	0	T	3.5
1898	T	T	T	0	0	0	0	0	0	T	0.2	3.0	3.2
1899	8.0	8.5	3.0	6.0	0	0	0	0	C	0	0.2	2.6	28.3
1900	T	10.5	0	T	0	0	0	0	0	0	0	T	10.5
1901	T	11.0	....	0	0	0	0	0	0	0	0	....	....
1902	16.2	0.5	T	0	0	0	0	0	0	0	T	T	16.7
1903	1.0	2.0	T	T	0	0	0	0	0	0	2.5	T	5.5
1904	12.5	4.0	T	2.5	0	0	0	0	0	0	0	3.4	22.4
1905	5.0	....	0	0.4	0	0	0	0	0	T	T	0	5.4
1906	3.5	7.2	4.5	T	0	0	0	0	0	0	3.0	0.5	18.7
1907	1.4	8.8	0	T	0	0	0	0	0	0	T	1.4	11.6
1908	2.0	3.0	T	0	0	0	0	0	T	0	T	T	5.0

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1909	8.0	0.8	0	T	T	0	0	0	0	0	0	1.2	10.0
1910	8.0	11.0	0	5.0	0	0	0	0	0	T	0	5.0	29.0
1911	T	0.4	....	0	0	0	0	0	0	0	T	T	....
1912	18.6	8.7	10.5	0	0	0	0	0	0	0	0	3.8	41.6
1913	1.0	3.3	4.5	0	0	0	0	0	0	0.5	0	4.5	13.8
1914	1.3	5.5	6.7	0	0	0	0	0	0	0	0.3	5.2	19.0
1915	4.8	0.7	1.1	T	0	0	0	0	0	0	T	5.0	11.6
1916	0.7	3.1	3.9	0.8	0	0	0	0	0	T	0.2	9.4	18.1
1917	5.7	11.2	1.6	T	0	0	0	0	0	T	T	19.5	38.0
1918	34.4	T	0	T	0	0	0	0	0	0	T	1.6	36.0
1919	1.5	1.2	T	0	0	0	0	0	0	0	0	0.4	3.1
1920	0.5	2.5	1.5	1.0	0	0	0	0	0	0	T	1.6	7.1
1921	3.5	9.4	0	T	0	0	0	0	0	0	0	0.3	13.2
1922	2.0	T	1.0	0	0	0	0	0	0	0	T	0.1	3.1
1923	T	0.9	T	0	T	0	0	0	0	0	0	0.5	1.4
1924	3.0	4.3	9.9	T	0	0	0	0	0	0	1.6	3.6	20.9
1925	5.0	0.5	1.0	T	0	0	0	0	0	5.0	0	0.9	12.4
1926	8.9	3.5	0.4	0	0	0	0	0	0	0	3.0	2.1	17.9
1927	0.6	4.9	5.1	T	0	0	0	0	0	0	T	0.1	10.7
1928	0.5	5.2	2.6	T	0	0	0	0	0	0	T	0.2	10.5
1929	0.5	10.3	0	0	T	0	0	0	0	0	2.6	7.6	21.0
1930	7.0	0.3	2.9	0	0	0	0	0	0	T	0.4	1.0	11.6
1931	4.0	0	0.5	T	0	0	0	0	0	0	0	0	4.5
1932	1.2	0	1.3	0	0	0	0	0	0	0	6.1	2.6	11.2
1933	0	2.8	0.2	0	0	0	0	0	0	0	0	0.5	3.5
1934	0.1	6.3	1.9	0	0	0	0	0	0	0	0	0.9	9.2
1935	0.3	T	0	0	0	0	0	0	0	0	T	5.8	6.1
1936	1.8	7.4	2.0	0.1	0	0	0	0	0	0	3.5	0.7	15.5
1937	6.5	4.2	0.3	0	0	0	0	0	0	0	1.9	0.2	13.1
1938	2.3	T	0	1.0	0	0	0	0	0	0	0.9	T	4.2
1939	7.6	18.6	T	0	0	0	0	0	0	0	0	10.3	36.3
1940	7.9	8.3	3.4	0.4	0	0	0	0	0	0	T	0	20.0
1941	0.1	3.1	1.1	0	0	0	0	0	0	0	0.1	1.8	6.2
1942	5.6	6.2	4.1	0	0	0	0	0	0	0	0	4.7	20.6
1943	0.4	1.3	4.8	0.1	0	0	0	0	0	0	0.4	1.2	8.2
1944	1.5	4.4	0.1	0	T	0	0	0	0	0	T	1.8	7.8
1945	4.4	0.9	0	0	0	0	0	0	0	0	T	6.7	12.0
1946	2.2	4.7	0	0	0	0	0	0	0	0	0	0.4	7.3
1947	0.1	2.5	17.3	0	0	0	0	0	0	0	T	3.7	23.6
Ave.	4.0	4.0	2.0	0.3	T	0	0	0	0	0.1	0.5	2.7	13.6

CAIRO

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1895	15.1	3.7	0.1	0	0	0	0	0	0	0	T	10.7	29.6
1896	0.2	1.8	1.2	0	0	0	0	0	0	0	0	T	3.2
1897	1.3	1.7	T	0	0	0	0	0	0	0	0	0.1	3.1
1898	0.4	0.4	T	0	0	0	0	0	0	0	T	3.0	3.8
1899	7.8	6.1	1.2	T	0	0	0	0	0	0	T	1.5	16.6
1900	0.6	7.2	0.5	T	0	0	0	0	0	0	0	0.9	9.2
1901	1.2	2.7	0.3	T	0	0	0	0	0	0	0	7.1	11.3
1902	0.1	4.5	0.7	0	0	0	0	0	0	0	T	0.2	5.5
1903	2.4	3.5	T	0	0	0	0	0	0	0	2.7	0.6	9.2
1904	2.9	1.7	T	0	0	0	0	0	0	0	0	0.8	5.4
1905	7.7	5.0	0	T	0	0	0	0	0	0	T	T	12.7
1906	1.2	3.8	1.0	0	0	0	0	0	0	0	4.3	0.8	11.1
1907	5.3	3.6	0	T	0	0	0	0	0	0	T	0.9	9.8
1908	1.3	1.2	T	0	0	0	0	0	0	0	0	0	2.5
1909	4.1	0.5	T	0	T	0	0	0	0	0	0	1.0	5.6
1910	7.7	3.9	0	1.6	0	0	0	0	0	0	T	4.1	17.3
1911	0.4	1.0	1.9	0	0	0	0	0	0	0	0.1	T	3.4
1912	7.4	3.6	6.6	0	0	0	0	0	0	0	0	3.2	20.8
1913	0.3	2.1	1.7	0	0	0	0	0	0	0	0	1.8	5.9
1914	0.2	3.9	3.5	T	0	0	0	0	0	0	0.3	6.3	14.2
1915	4.5	0.1	0.1	0	0	0	0	0	0	0	T	1.5	6.2
1916	0.2	1.3	0.5	T	0	0	0	0	0	0	1.0	3.3	6.3
1917	6.9	1.1	2.8	T	0	0	0	0	0	0	T	22.7	33.5
1918	24.2	0.8	0	T	0	0	0	0	0	0	0	T	25.0
1919	0.7	1.1	0	0	0	0	0	0	0	0	0	T	1.8
1920	T	4.3	0.2	T	0	0	0	0	0	0	T	0.4	4.9
1921	4.5	9.0	0	T	0	0	0	0	0	0	T	T	13.5
1922	4.0	T	T	0	0	0	0	0	0	0	T	0	4.0
1923	0	1.2	T	0	0	0	0	0	0	0	0	0.4	1.6
1924	2.0	2.4	2.0	T	0	0	0	0	0	0	T	2.5	8.9
1925	3.4	T	1.3	0	0	0	0	0	0	2.0	0	1.1	7.8
1926	6.0	2.4	T	0	0	0	0	0	0	0	0.5	1.2	10.1
1927	T	1.2	3.3	0	0	0	0	0	0	0	T	T	4.5
1928	T	0.3	0.1	0	0	0	0	0	0	0	0	T	0.4
1929	T	11.5	T	0	0	0	0	0	0	0	T	6.6	18.1
1930	5.5	T	0.3	0	0	0	0	0	0	T	T	3.5	9.3
1931	7.3	0	0.5	0	0	0	0	0	0	0	0	0	7.8
1932	0.9	T	2.0	0	0	0	0	0	0	0	1.6	2.0	6.5
1933	T	3.8	T	0	0	0	0	0	0	0	0	T	3.8
1934	T	1.3	1.4	0	0	0	0	0	0	0	0	1.5	4.2
1935	0.1	T	0	0	0	0	0	0	0	0	T	4.7	4.8

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1936	1.4	8.0	T	T	0	0	0	0	0	0	4.3	T	13.7
1937	T	3.6	T	0	0	0	0	0	0	0	1.3	0.5	5.4
1938	1.1	0.1	0	T	0	0	0	0	0	T	0.4	T	1.6
1939	2.1	12.0	T	0	0	0	0	0	0	0	0	1.9	16.0
1940	7.8	4.3	2.6	T	0	0	0	0	0	0	0	0.2	14.9
1941	T	2.4	1.3	0	0	0	0	0	0	0	T	T	3.7
1942	5.4	1.3	0.2	0	0	0	0	0	0	0	0	2.4	9.2
1943	1.9	0.8	4.5	0	0	0	0	0	0	0	T	0.5	7.7
1944	1.8	5.9	0.1	0	0	0	0	0	0	0	0	0.6	8.4
1945	3.7	0.1	0	0	0	0	0	0	0	0	T	4.5	8.3
1946	0.2	1.4	0	0	0	0	0	0	0	0	0	1.6	3.2
1947	T	6.2	4.0	0	0	0	0	0	0	0	T	0.8	10.8
Ave.	3.1	2.8	0.9	T	0	0	0	0	0	0	0.3	2.0	9.1

spots of extremely low temperature, especially where air drainage is an added factor. In central and southern Illinois temperatures below zero are seldom recorded except when a snow cover is present. For example, out of the 58 days in the last 15 winters (1933-34 to 1948-49) at Springfield which had temperatures of zero degrees Fahrenheit or below, fifty of them had a snow cover of a trace or more. Three of the other 8 had had a trace or more the preceding day and on the other five days the snow cover began just north of Springifield and extended into Iowa, Wisconsin, and Minnesota. This would indicate that a snowcover is almost essential to the maintaining of low temperatures obtained by the air mass in its northern region until it reached central Illinois.

SNOWFALL AND FLOODS

The part that snowfall and snow cover play in the creation of floods in Illinois appear to be less definite than in some other sections of the United States. E. E. Foster[1] cites two examples, the 1936 flood on the Connecticut River and the 1943 flood of the Middle Missouri, in which rapid melting of snow was almost entirely the cause of serious floods. Quite similar conditions could exist in Illinois but more often floods develop from a number of factors.

In a widespread snow cover melting usually commences at the surface of the snow with the water percolating downward. The melted water does not run off immediately but stays in the snow increasing its density and at the same time decreasing its depth. Only when the maximum density is reached will actual runoff begin. Foster[2] points out six important factors reducing a snow cover, of which insolation, turbulent exchange of heat from the air, and condensation of atmospheric moisture are the most effective for producing a snow cover of high density

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1. Foster, E. E., Rainfall and Runoff, 1948, pp. 256-58.

2. Ibid, pp. 241-42.

and water content. A large water shed having frozen ground with a heavy snow cover that is subjected to an influx of warm mf air, either with or without rainfall, is an excellent setting for a flood. It should also be remembered that a large portion of the winter's precipitation can be stored up in a heavy snow cover and released suddenly in the manner suggested above. However, in Illinois most floods appear to be the result of heavy spring rains, but often combined with the added effect of snow melt or snow water and the formation of ice gorges. It is also true that the spring floods caused by heavy rains are floods only because the rain fell at times when the streams were already full from melted snow. This is especially true when the subsoil remains frozen. The shape and orientation of Illinois with its major length from north to south rather than from east to west has surely aided in the prevention of floods. If, for instance, the state had its long axis from east to west and the Mississippi River ran the full length but was on the southern side of the state and a large snow cover existed over most of the state, an inflow of mf air with rain would release a large volume of water and all at nearly the same time over the whole state, flooding much larger areas than is now possible along the north-south streams.

If flooding is caused by ice gorges and a snow cover exists, warm weather will melt the snow cover faster than it will the ice of the gorges and increase the severity of the flood. An example of this condition occurred along the Illinois River from February 19 to 22, 1937. A light to moderate snow covered the water shed, and advection of warm air accompanied by moderate to heavy rains caused rapid melting of the snow and ice, resulting in rapid runoff. Ice gorges formed in the river causing local flooding which was increased by the rate at which runoff continued in contrast to the rate which the ice gorges were destroyed.

Foster[1] states that in regions where appreciable snow remains on the ground during the winter, spring is the season of floods. Such is the case in Illinois as in all the upper Mississippi Valley but it is not possible to attribute the cause of many of these floods directly to snow conditions, since, in many years "appreciable snow" does not remain on the ground through the winter or any large part of it. The highest river stages ever reached at some of the stations maintaining official gauges are as follows:

FLOOD STAGES REACHED AT ILLINOIS CITIES

Station, flood stage and river.	Dates of flood	Stages reached
Moline, flood stage 10 feet Rock River	March 11, 1929 June 27, 1892	14.9 feet 14.0 feet
Morris, flood stage 13 feet Illinois River	May 21, 1942 March 18, 1919 Spring 1831	21.6 feet 20.3 feet 26.2 feet
Henry, flood stage 10 feet Illinois River	May 18, 1933 April 4, 1926 March 28, 1904	18.7 feet 15.8 feet 17.2 feet
LaSalle, flood stage 18 feet Illinois River	March 8, 1908	28.8 feet
Peru, flood stage 17 feet Illinois River	May 22, 1943 Jan. 23, 1916	27.7 feet 27.0 feet
Peoria, flood stage 18 feet Illinois River	May 23, 1943 May 18, 1933 April 5, 1926 March 1849	28.6 feet 25.4 feet 23.0 feet 27.1 feet
Beardstown, flood stage 14 feet Illinois River	May 26, 1943	29.7 feet
Kankakee, flood stage 8 feet Illinois River	March 26, 1916	10.3 feet

1. Foster, R. E., Rainfall and Runoff, 1948, p. 255.

Station, flood stage and river.		Dates of flood	Stages reached
Quincy, flood stage Mississippi River	14 feet	June 5, April 23, 1929	22.1 feet 21.4 feet
Mt. Carmel, flood stage Wabash River	19 feet	March 30, 1913	31.0 feet
Alton, flood stage Mississippi River	21 feet	June 9, 1903	33.8 feet

Stations along the Mississippi and Ohio rivers were omitted, for the most part, since floods at those stations are usually the results of conditions outside of, rather than in Illinois. Floods occurring in May or June cannot be directly associated with runoff from snow. Floods in Illinois that can be attributed directly to rapid runoff from snow must generally occur in February, March or early April. The March flood of 1929 on the Rock River reached the highest stage ever recorded at both Rockford and Moline. This flood was the direct result of above freezing temperatures and general thawing of a light to moderate snow cover causing rapid runoff into an already swollen stream obstructed by ice gorges. The March flood of 1919 at Morris was the direct result of heavy rain storms and occurred at the end of a winter of very little snowfall. The highest stage ever reported at Morris was in the spring of 1831, following the winter in which according to some accounts had the greatest snow storms of the last century.[1] The flood of April 1926 effected the entire Illinois river and was directly attributed to the late heavy snow storm of March 30 and 31 and the high temperatures following that caused rapid melting. Above flood stage was reached at Morris from March 31 through April 6 and stages of from 4 to 6 feet above

1. United States Department of Agriculture: Climate and Crop Service of the Weather Bureau, Illinois Section, Feb. 1900.

flood stage were recorded at Peru, Henry, and Peoria until April 6. The March flood of 1904 at Henry came at the end of winter with 50.5 inches recorded snow. The melting of this snow kept streams at flood stage throughout most of March. Snowfall played an important part in the March 1908 flood at LaSalle. This is another example of heavy February snowfall maintaining streams at high levels followed by an unusually mild March with little snowfall but abundant rain, the rain being the immediate cause of flooding. Snow cover was a definite factor in the 1916 January flood at Peru. On January 17, 1916 there were two inches of snow over the northern half of Illinois. This was immediately followed by a period of both warm and rainy weather with two inches of rain falling over the area. Runoff was rapid and rivers rose at rapid rates. Ice gorges developed and were dynamited but flood waters reached 23.1 feet at Peoria and 20.7 feet at Beardstown. The highest stages ever reached at Peoria and Beardstown followed periods of excessive rainfall too late in the spring to permit snow to play a part in their development. The March flood of 1916 at Kankakee was the flas type flood due entirely to heavy thunderstorm. The 1913 flood at Mt. Carmel was due to unusually heavy spring rainfall throughout the Wabash Basin.

There are at least some cases where snow may help prevent flood conditions. If heavy rain falling on an area already near to flood conditions were to change to snow and be followed by lower temperatures the rapid runoff would be decreased and stored by a later period giving streams a chance to return to near normal stages. If a snow cover lies over a region where the transfer of heat from the substratum upward is enough to melt the ground ice and the bottom layers of the snow cover, the melt will decrease the density of the snow and the water may make its way into the ground rather than into the runoff.

SNOWFALL AND TRAFFIC

One of the almost obvious consequences of a heavy snowfall is the effect it can have on transportation. Operating efficiency is cut and the accident hazard increased immediately with the beginning of the falling snow and the resulting marked decrease in visibility.

Snow removal and ice control work is a major activity of the field maintenance organization of the Illinois State Highway Department during the winter months. Snow removal equipment is maintained and kept ready for immediate use whenever snow begins to accumulate on the pavements. Twenty-four hour operation is continued, if necessary, to open highways or to keep them open. Preparation in the fall of the year consists in the building of stock piles of cinders near intersections and steep grades, the attempted strategic distribution of snow plows and other snow removal equipment, as well as the installation of snow fences in locations where severe drifting has repeatedly occurred or in areas where it would be expected. Snow removal and ice control costs for the state exceeded one and a half million dollars in 1947 and over a million dollars in each of the two preceding years. It should not be concluded that cost is a function of total snowfall alone but is the result of intensity of individual snowfalls, the amount of drifting, freezing, and thawing, the time between storms, and the fluctuating costs in labor and equipment. It is possible for a year of small total snowfall to cost more than a year of a greater annual amount, if, in the year of small annual total most of the snow is concentrated in a few heavy storms. For example, in northern Illinois the snowfall averaged 23.8 inches in 1931 and 27.4 inches in 1932 but the cost of removal per mile was $55.23 in 1931 and only $37.02 in 1932. Both years had below normal snowfall and each had a heavy March storm. In 1931 a heavy snow on the 18th and 19th of January caused highway traffic tie-ups. February snowfall was very light. However, a heavy

snowstorm occurred on March 5 to 9 with much drifting and below average temperatures so that it remained on the ground for more than a week. Three snowfalls in December completed the total for that year. The year 1932 was one of unusually mild temperatures and late spring snowfall. Very little snow fell in January and February and melted rapidly when it did. A heavy snow storm occurring on March 21 and 22 was referred to by some as "blizzard like"[1] even though mild temperatures and widely scattered thunderstorms were associated with it. This storm created immediate traffic problems but melted rapidly during the next two days. The heaviest snowfall of the remainder of the year was an early fall storm on November 15 and 16. Amounts varied from 3 to 13 inches and was one of the heaviest early snow storms on record. The only December snow of any consequence fell on the 9th and 10th. Thus ended a year of almost normal total snowfall but not normal in that most of the snow came in heavy spring and fall storms with little snow during December, January, and February. The Highway Department, therefore, was confronted with two heavy storms widely separated as to time, and occurring in warmer seasons. This resulted in less total expenditure, than would have been true in a winter of more frequent but smaller snow storms.

Snowfall presents several problems to the railway systems of Illinois, especially those of the northern part of the state. Measures are taken to prevent the accumulation of snow on the right-of-way, such as decreasing the slopes on the cuts and construction of snow fences, both portable and permanent. More serious problems are encountered at terminals where tracks are close together as well as service buildings to which access must be obtained that there is very little space left to dispose of the snow. It is necessary to either melt the snow or to haul it to some point of disposal. Snow also creates a problem in

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1. United States Weather Bureau: Climatological Data: Illinois Section, March 1932, p. 10.

connection with switches and crossings in as much as the snow gets into the operating mechanism and prevents their functioning. The snow must be cleaned out either by hand or by the use of snow melting equipment such as switch heaters operated by oil, gas, or electricity. Freight traffic suffers from heavy wet snows not only because of slippery tracks but also because of the extra weight of the snow.[1] In the case of a heavy wet snow as much as a ton could be added to the weight of each flat car or coal car.

The effect of snowfall on air traffic is almost equally important. Both take-off and landing are made extremely dangerous with the restricted visibility caused by the falling snow. Snow on the ground and on the runways makes it difficult for the pilot to locate the runway and the wheels of the plane may run off or miss the surface of the runway dropping into the mud or rough ground. The thin layer of snow often left on the runway after snow removal equipment has been used is usually well packed and becomes slick, causing danger of side slipping and the need of excessive distances to land planes, since the brakes must be cautiously applied. Diurnal variations in temperature are often large enough to effect day time melting and night time freezing producing ice surfaces or surfaces which are alternately bare and ice covered. Snow removal equipment and personnel must be available to all first class airports and weather forecasting personnel must have the added responsibility of attempting to forecast the amounts of snowfall far enough in advance to give preparation for its timely use.

Accidents of aircraft in flight due to falling snow have been mainly of two types, carburetor icing, and the jamming of controlled surfaces. Engine failure has been attributed to severe carburetor icing during heavy snow storms where enough snow was able to pass through the heated intake ducts and actually clog the butterfly valve of the carburetor. The snow at flight levels is usually at

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1. Brooks, C. F.: Snow in Railroading, Science Service, January 2, 1925.

low enough temperatures that it will not stick to the surfaces of aircraft in sufficient quantities to be hazardous. If the snow is encountered at near melting temperatures and the snow is wet, a mixture of snow and rain, or slush, dangerous icing can result. The wet snow may form ice on the leading edge of the wings and change the airfoil enough to destroy the "lift" of the wings, but more often the snow melts on striking the surface with the water running back over the wing and freezing in the controlled surfaces resulting in loss of control of the plane.

An example of this type of weather situation is illustrated by the air mass soundings over Joliet on January 17 and 18, 1949, (Fig. 2). The air from which the snow was falling above the inversion at 850 millibars was only one degree centigrade. During the following 12 hours the temperature rose to above freezing and at the surface the snow was followed by freezing rain. Icing conditions would have been serious at either of these times or any time between the time of the soundings. The weather maps in Figures, 4, 5 and 6, chosen to illustrate typical heavy snowfall synoptic patterns, also illustrate extremely bad flying weather. For example a plane flying into Chicago at noon on December 10, 1944, (Fig. 6) would have found landing conditions almost impossible. The ceiling was 400 feet and indefinite, visibility was 0.2 of a mile with heavy snow, and gusty winds from the east. For safety precautions the plane would most likely have to be sent to an alternate landing field such as Grand Rapids or Detroit with poor flying conditions encountered most of the way.

SUMMARY

Several specific points about the snowfall of Illinois have been shown. Variations in amounts and years have been conspicuous but no systematic or long period changes could be indicated at least within the time of record. In general, snowfall increases from south to north. January is the month of most snowfall in the central and northern sections but February is the month of maximum in the

southern section. March is a month of extremes with little or no snow in many years but quite often a month with the heaviest individual storm. The majority of snow storms are associated with the cold fronts of the migrating cyclones but the warm front is almost essential to the development of the heavy snow storms.

Some of the consequences of snow as related to traffic have been noted with an attempt to show particularly the conditions for aircraft in relation to terminal conditions. With the development and improvement in stratospheric flight which could be made well above any severe snow storms, the take-off and landing during a heavy snow storm would still be extremely hazardous even though it were aided by Ground Control Approach Equipment.

No significant correlations exists between snowfall in February and March and temperatures for the following April and May.

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